

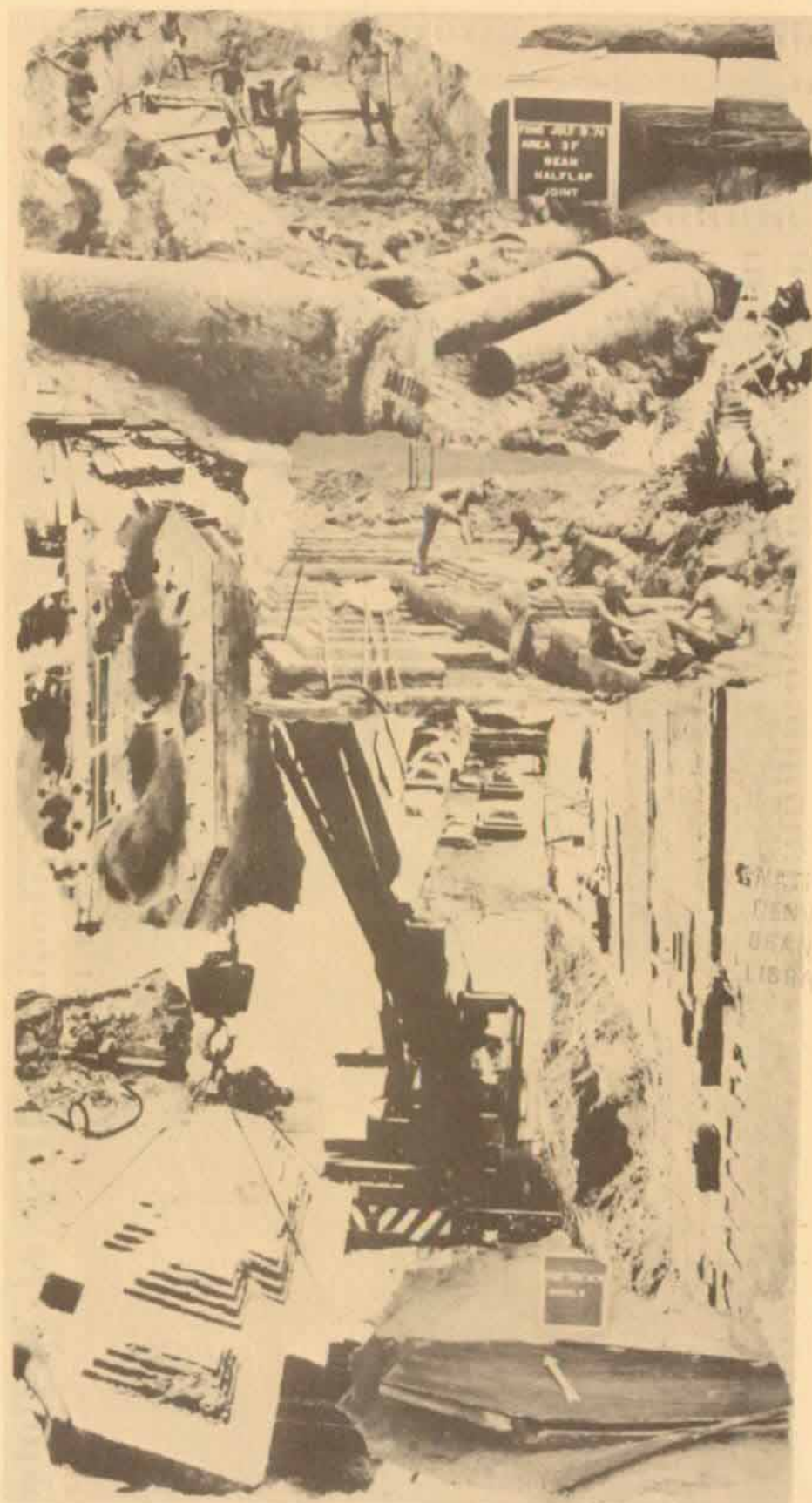
Fort Moultrie

SOUTH CAROLINA

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ARCHEOLOGICAL INVESTIGATIONS
AT
FORT MOULTRIE
SULLIVAN'S ISLAND, SOUTH CAROLINA

(PRELIMINARY REPORT)

BY

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U.S. DEPARTMENT OF THE INTERIOR

1977

FOREWORD

During the spring and summer of 1974 the Southeast Archeological Center continued an investigation of archeological resources in certain areas within Fort Moultrie National Monument. The project, initiated in 1973 under National Park Service contract with the South Carolina Institute of Archeology and Anthropology, was necessitated by the Fort Sumter National Monument Master Plan; a part of which called for the completion of archeological research needed to restore and interpret the resources of Fort Moultrie. Archeological investigations were also to be conducted where proposed constructions might adversely affect archeological or historical values.

The initial goal was the continued archeological investigation of an area northeast of the present Fort Moultrie #3 in hope of discovering the northeast bastion of Fort Moultrie #1, suspected to be located in this vicinity.

As in every cooperative effort, many individuals deserve recognition and thanks. We are indebted to our crew who provided the work force necessary to undertake this research. A special thanks goes out to Elizabeth Lalor, Dana Linck, A. Wayne Prokopetz and Elizabeth Righter who served as field supervisors. Laboratory assistance was provided by James Carter, Michael Clancy, Elizabeth Lalor, Patricia Logan, Carl Merry, A. Wayne Prokopetz, Elizabeth Righter and James Thomson.

We are indebted to Dr. Robert Stephenson, Stanley South and John Combes of the South Carolina Institute of Archeology and Anthropology for their interest, cooperation and support throughout the Fort Moultrie Archeological Project. We are grateful to Carl R. Falk, Chief, Midwest Archeological Center, for the support provided by his staff including Bob Nickle who identified bone debris recovered and Jerry Livingston (illustrator) and Wayne Nelson (photographer). All provided technical services which have done much to enhance this report. We are deeply grateful to Richard Faust, Chief, Southeast Archeological Center, for the necessary support he provided our research. In conclusion, a special thanks to the staff of the Fort Moultrie National Monument who throughout the investigations furnished much assistance and encouragement.

This manuscript is representative of diversified analytical approaches and includes the work and thoughts of several people. However, Dick P. Hsu and John E. Ehrenhard had the duty of preparing the report and all errors and omissions are their responsibility.

JEE

TABLE OF CONTENTS

Foreword	iii
List of Illustrations.	vi
List of Tables	viii
Preface.	ix
Introduction	xi
Excavations.	1
a. Excavation Procedures.	3
b. Excavations 1 and 6.	4
c. Excavations 2 and 3.	15
d. Excavation 4	21
e. Excavation 5	27
f. Excavation 7	37
g. Excavation 8	38
Conclusions.	39
References	45
Postscript	46
Notes.	56
Appendix A. Cemetery	60
Appendix B, Hydrological Problems and Findings	73
Appendix C, Coding Key for Moultrie Artifacts.	92
Appendix D, Faunal Remains	119
Appendix E, Soil Resistivity Study of Fort Moultrie II	123

Errata

On page 30 of the following report the second paragraph is incorrect. The correct version of this paragraph is given below.

As a result of all the filling in the parade ground, the 1808 surface level from which construction began was over three feet below grade in the center of the fort and over 14 feet near the curtain wall. The primary objectives of this unit were to ascertain the original parade level, locate the west barracks and parade wall (both reportedly removed in total) and to test a hypothesis proposed by Architect John Garner that the Fort Moultrie III west barracks were built on or near the Fort Moultrie II barracks which were originally built in 1784 as a pest house on the foundations of the former officers barracks of Fort Moultrie I. Locating the foundations of the first barracks would help define the location of Fort Moultrie I.

TABLE OF CONTENTS

Foreword	iii
List of Illustrations.	vi
List of Tables	viii
Preface.	ix
Introduction	xi
Excavations.	1
a. Excavation Procedures.	3
b. Excavations 1 and 6.	4
c. Excavations 2 and 3.	15
d. Excavation 4	21

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LIST OF ILLUSTRATIONS

1. Charleston Harbor and Environs	vi
2. Location of Excavations by NPS Archeologists	2
3. 20th Century Hospital Foundation	5
4. Detail of Sleepers (19th Century Hospital Foundations)	6
5. 19th and 20th Century Hospital Foundations	8
6. Profiles of Palmetto Stumps in Excavation 1.	13
7. Excavation 6	14
8. Detail of Beam Half Lap.	16
9. Detail of Notched Beam in Excavation 3	17
10. Outline of Moultrie 3 and Beam Construction to the East, Thought to be Moncrief's Fort.	20
11. Soil Profiles in Excavation 2.	22
12. Excavation 2	23
13. Excavation 4	24
14. Excavation 5	28
15. Excavation 5 - Units B-C-D	33
16. South's Conjecture of Fort Moultrie I.	40
17. NPS Conjecture of Fort Moultrie I.	42
18. West Wall of Storage Magazine.	50
19. Plan of Fort Moultrie III.	51
20. thru 22. Construction Detail of Eliason Palisade	52
23. Detail of Beam Construction in Unidentified Feature.	58
24. Location of Dyer Cemetery Plot	61
25. Water Main in Excavation 4 Overlying Casket No. 6.	67

26.	Modern Brick Rubble and Electrical Conduit Intrusion on Casket No. 15.	68
27.	Two Styles of Caskets: Unequilateral Hexagon (Casket No. 9) and Regular (Casket No. 10).	69
28.	Excavation of Casket No. 5.	70
29.	Porosity, Specific Yield, and Specific Retention Variations with Grain Size.	75
30.	Pore Volumes.	77
31.	Subsurface Occurrence of Groundwater.	78
32.	Sand and Gravel	81
33.	A Well-Point System to Dewater an Excavation Site	82
34.	Drawdown Curve and Cone of Depression	84
35.	Individual and Composite Drawdown Curves for Three Wells in a Line	86
36. thru 45.	Bottle Forms Found at Fort Moultrie.	109 - 118
46.	A Diagramatic Illustration of the Popular Four Probe Configuration and a Method to Compute the Apparent Resistance.	129
47.	The Area Investigated for Resistance Anomalies.	132
48.	A Three Dimensional Resistance Contour Map of the Suspected Area of Fort Moultrie II	133
49.	A Three Dimensional Resistance Contour Map of the Suspected Area of Fort Moultrie II	134
50.	A Three Dimensional Resistance Contour Map of the Suspected Area of Fort Moultrie II	135

LIST OF TABLES

1. Descriptive Data from Cemetery Area	66
2. Bos Taurus Remains from Fort Moultrie	120
3. Sus Scrofa Remains from Fort Moultrie	121
4. Miscellaneous Faunal Remains from Fort Moultrie	122

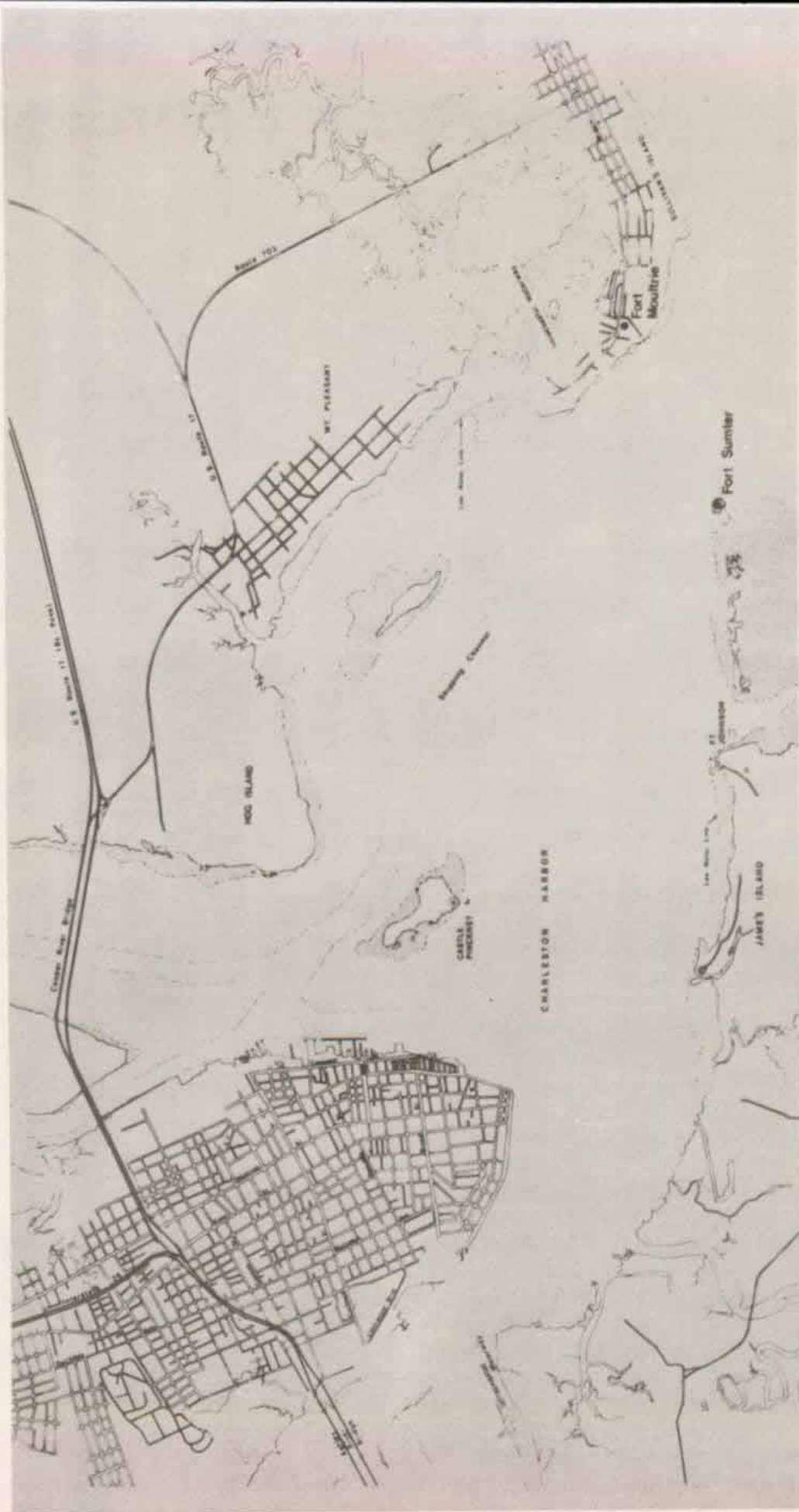
PREFACE

Fort Moultrie, incorporated in the Fort Sumter National Monument, is located on the southern end of Sullivan's Island, Charleston, South Carolina (Figure 1). Its salience in American history results from the "Battle of Sullivan's Island" which occurred on June 28, 1776. At this time an attacking British fleet was successfully repulsed from the Charleston Harbor. It was America's first victory in her struggle for independence and provided a major contribution in halting the British occupation of the southern colonies early in the war.

Fort Moultrie, a military establishment from 1776-1947, represents 170 years of military history and coastal defense including the Revolutionary War, the War of 1812, the Civil War, the Spanish-American War and World Wars I and II. In the 170 years, three forts have been constructed to aid in the defense of the Charleston Harbor.

Moultrie #1, only partially completed in 1776, was destroyed by storms and in time eroded away. Moultrie #2, built between 1794 and 1798 during the quasi-war with France, was battered by high tides in 1803 and wrecked by the hurricane of 1804 (Bearss 1968a:Plate VI). Construction on Moultrie #3, which stands today, commenced in 1807 and was completed in 1809. Comprehensive discussions of the three forts may be found in Bearss (1968a,b).

Anticipatory to America's bicentennial celebration, and in keeping with the National Monument Master Plan, Fort Moultrie was programmed for special development.



Charleston Harbor & Environs

FIGURE 1. Charleston Harbor and Environs

INTRODUCTION

The Fort Moultrie area will be developed to interpret the evolution of coastal defense and armaments in America since 1776. Rehabilitation and restoration/reconstruction of structures existing or known to have existed in the area of Moultrie #3 are to be the principle features of development (FOSU Master Plan 1974:2).

Improvements were to center on: 1) the construction of a visitor contact/interpretive facility with parking space for 200 autos; 2) restoration and interpretation of Moultrie #3 which will require the removal of some portions of the historic fabric to expose earlier and historically more significant features; 3) removal of the 1863-65 earthfill within the confines of Moultrie #3; and 4) locate and expose foundation ruins of Moultrie #1 and #2 as interpretive features.

In response to the development concept plan and in keeping with policies of the National Park Service, archeological and architectural investigations of the historical and cultural resources of Fort Moultrie were undertaken. Initial exploratory archeology at the fort was completed under NPS contract with the Institute of Archeology and Anthropology, University of South Carolina in the fall of 1973. This work was directed by Stanley South (South 1974). His excavations exposed two widely separated features which were hypothesized as relating to the first fort. One feature was a pair of parallel 1-foot square timbers that had a configuration of a curtain wall and a bastion's face and flank.

This was interpreted by South (1974) as being part of the east curtain and east portion of the northeast bastion of the first fort. The other feature was a ditch and associated fill that has been interpreted as the ditch protecting the main gate (South 1974).

Continuation and expansion of the investigations initiated by the Institute were undertaken by the National Park Service in the spring of 1974. The additional archeological work supervised by NPS Archeologists John E. Ehrenhard and Dick P. Hsu began May 15, 1974 and terminated August 4, 1974. The focus of the additional research included the following:

- 1) Investigation of military hospital site located north of Moultrie #3 in the area of the proposed visitor center and parking lot.
- 2) Recovery of additional information through expanded excavations into the size, shape and construction of the northeast bastion of Fort Moultrie #1 postulated by Stanley South (South 1974).
- 3) Location, if possible, of the north and east curtain walls of the northeast bastion.
- 4) Determination of the extension of the ditch and abatis found to the west of the bastion extended into the bastion area and define the relationship, if any, between the two features.

- 5) Determination, if possible, of the location of Moultrie #2, foundations of which are believed to exist south of the present fort.
- 6) Undertaking of archeological investigations within Moultrie #3 to locate the parade ground and barracks foundations of that fort; involving the removal of considerable overburden with the aid of heavy earth-moving equipment.
- 7) Further investigation to determine whether the protective cushion of the parade ground, once removed, might reveal features of the 1776 period of Moultrie #1.

The National Park Service has now completed its archeological investigations and salvage at Fort Moultrie. The research objectives mentioned above were undertaken on a priority basis, and the results and recommendations of these operations are covered in the following chapter.

EXCAVATIONS

Our chief purpose as archeologist, historic or otherwise, is the recovery of culture history. In historical situations we must use the specific historical data available to aid in the interpretation. However, it often occurs that the historic documentation does not answer the kinds of questions asked; the pitfall then becomes the misuse of written historical documentation as the basis for ill-founded hypotheses. A major task of historic archeology is to correctly integrate historical documentation and the archeological record.

A major concern at Fort Moultrie was the recovery of artifacts in the matrix of a dated site. Here there are contextual relationships between artifact types representing a 170-year span of cultural time and space. The origin of artifacts within this matrix as well as their location is one of the main factors in the interpretation presented in this work.

Eight excavations were undertaken at Fort Moultrie (Figure 2). Each was designed to provide information necessary to preserve or mitigate any cultural resources that might be threatened by construction activities; a search for the remnants of Moultrie I was considered as part of each test. Regretfully, the discussion of these excavations is brief. It is an unpleasant experience for any archeologist to spend nine weeks in the field and continually produce negative evidence, not so much because he has not "found" anything but rather why has nothing



FIGURE 2. Location of Excavations by National Park Service Archeologists

been found. In our experience at Fort Moultrie the answer is quite simple....there was little or nothing to find. This presents the authors with the unpleasant task of reporting on unimaginative non-existent data. All of our tests revealed essentially mixed deposits with no significant separation of cultural debris by provenience and as artifacts in many cases are present from a time period later than that documented we are forced to deal in our analysis with the entire temporal range represented (South 1974). Thus, in this report there are no pictures of musket balls or creamware sherds (South 1974) nor is there discussion of vast amounts of corroded metal, modern beer bottles or Civil War debris. Examples may be found in other sources which deal with this material that is discussed but would not add to our understanding of Fort Moultrie. However, this information is on file at the Southeast Archeological Center in Tallahassee, Florida.

Excavation Procedures

All of the areas that were to be excavated had 4 to 12 feet of fill covering the features that were to be investigated. Most of the filling occurred during and after the Civil War. None of the references indicated the source of the fill material. Artifacts in the fill ranged in dates from 1750's to 1950's. The prior excavation (South 1974) demonstrated that all Revolutionary War Period features were below the present water table, irrespective of the depth below present grade. A backhoe was used to remove the overburden to the water table; well points were placed to lower the water then the remaining overburden was removed by shovel and trowel. Both stratigraphic and arbitrary

levels were used, depending on the particular circumstances of a given excavation unit. The size of an excavation unit depended upon the architectural structures found in the unit. Subunits within main units were determined by specific architectural features, i.e. rooms, fireplace, walks, etc. All excavation units were taken to sterile earth and test pits were dug to verify that no cultural remains were below the final excavation level.

Excavations 1 and 6

Our first priority of the summer was the investigation of a recent military hospital located north of Moultrie #3 in the area of the proposed visitor center. Excavations were undertaken here and a number of unforeseen problems surfaced almost immediately. The foundations of this building were intact (Figures 3 & 4). Debris filled the interior perimeter of a solid brick and concrete foundation and it was apparent that when the building was razed large portions of it were pushed into the "cellar" as fill. No significant materials were recovered as the artifacts consisted primarily of modern medicine bottles, broken furniture, electrical wire, bricks, and broken glass. It was necessary to remove this rubble if we were to determine the presence or absence of cultural materials in lower levels. The foundations were undercut so as to be able to run cable beneath them; a 20-ton crane then hoisted the material free of the excavation. Removal of this debris revealed that the hospital foundations were resting in some places on 4" x 8" pine planks. Some of which measured 20 feet in length (Figure 4). It was hoped that there would be



FIGURE 3. 20th Century Hospital Foundation

FOMO
Piling Plan View & Cross-Section

0 1 2 3 4 5 Feet
jll

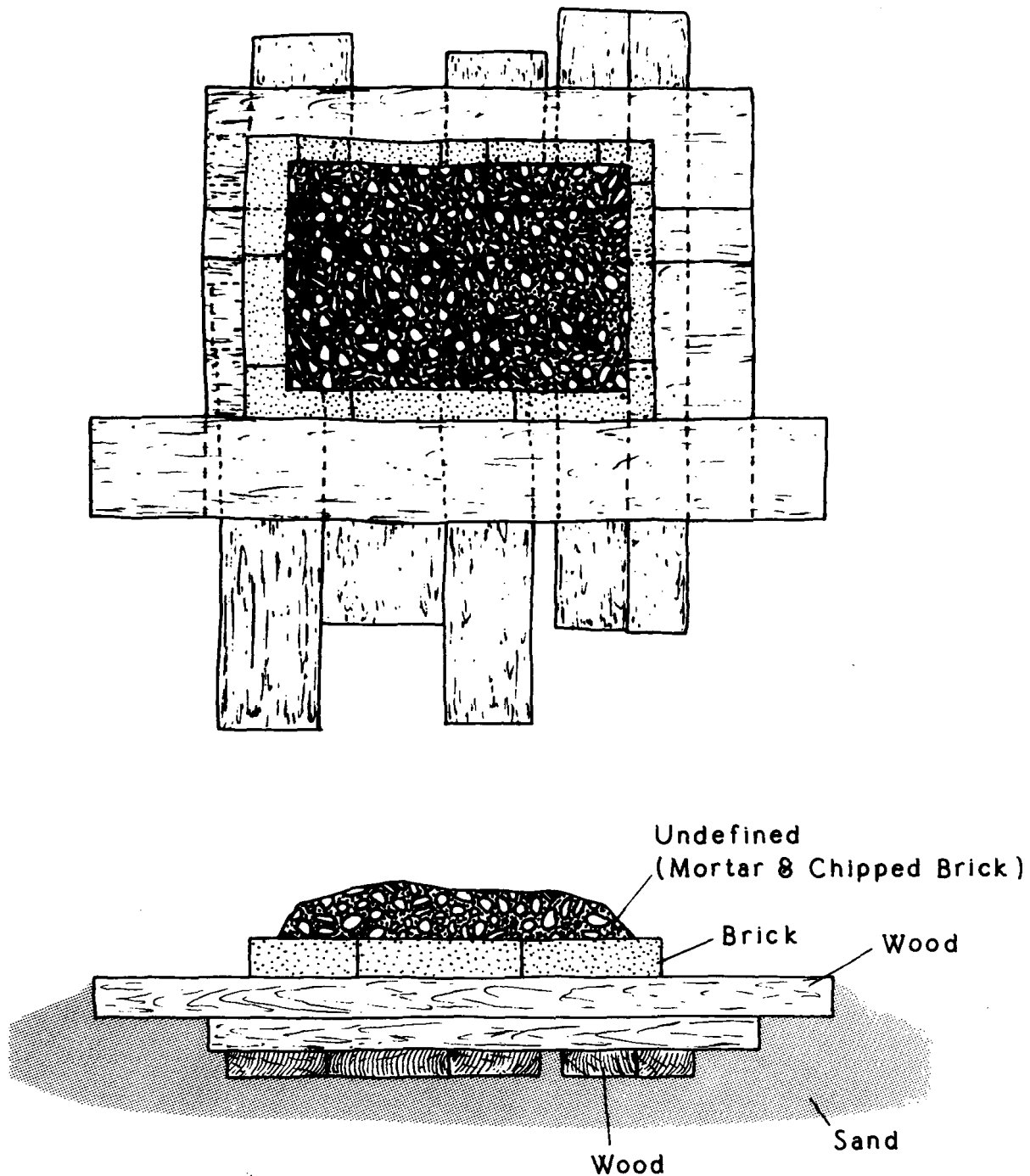


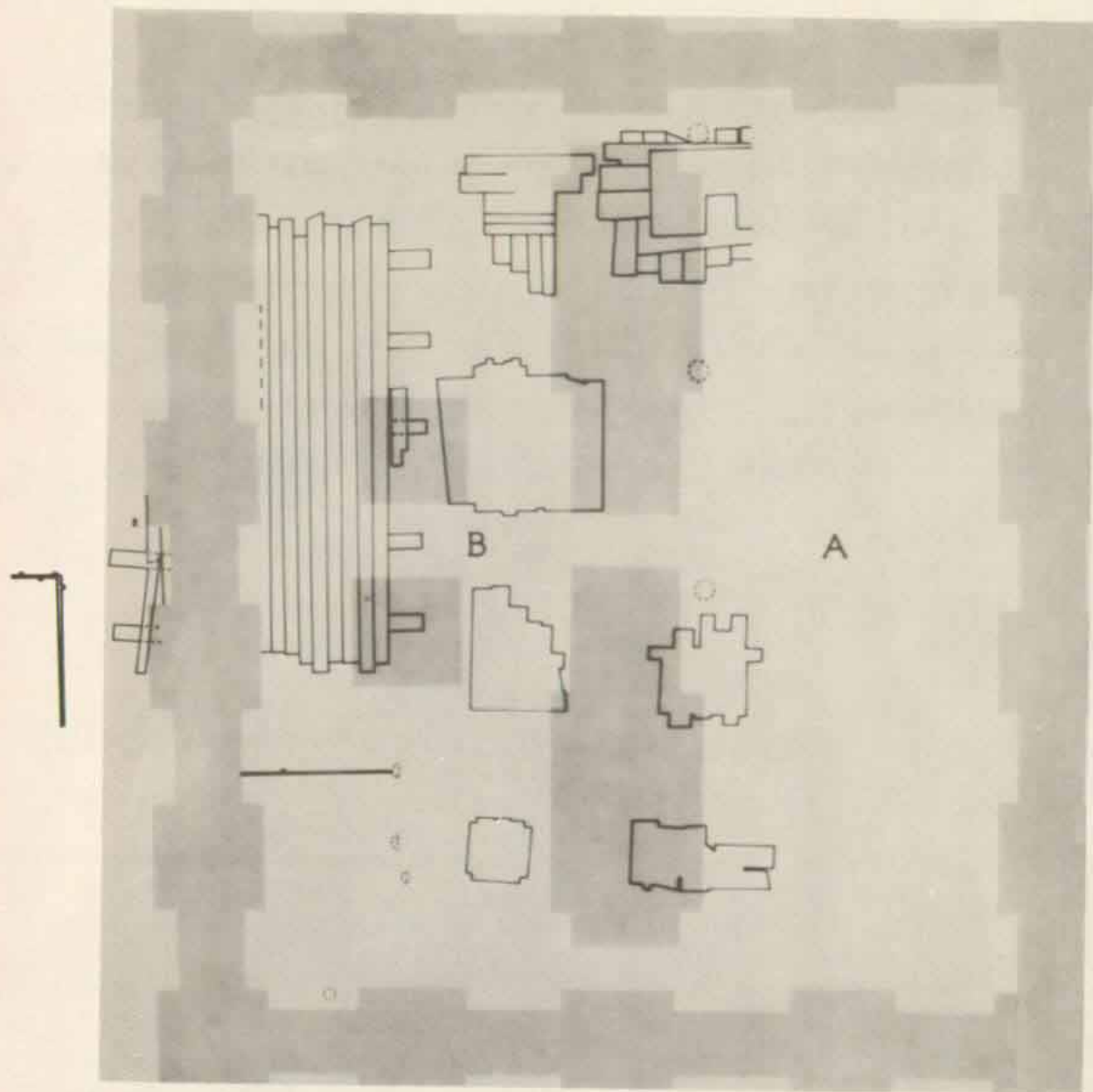
FIGURE 4. Detail of Sleepers (19th Century Hospital Foundations)

considerable structural detail found. Our enthusiasm was short-lived as research of historical documents indicated that these wooden planks and brick piers were the remains of an earlier hospital constructed¹ here in the middle 1830's (Figure 5). Unfortunately almost no cultural material was located. This is most likely because of its removal when building the later military unit. The little data recovered consisted of white earthenware, flat glass and corroded metal fragments.

The historical documents giving descriptions of the hospital and adjacent buildings follow below:

Specifications for the usual alterations and repairs of masons' and carpenters' work of several buildings at the United States Garrison on Sullivan's Island as is shown in plans accompanying and as explained as follows VIS-A-VIS. Plan No. 1 shows the situation of the several buildings as they now stand on the ground. Plan No. 2 shows the situation of the several buildings after removal with the distances marked out to move in their respective places. The different items of work to be performed and the quantity of materials to be furnished as specified in the following order VIS-A-VIS.

No. 1 - As designated in Plan No. 1 is the hospital, a frame building 50 ft long by 26 ft deep, two stories high with hipped roof and elevated 3 ft 9 ins on 14 brick piers 2 ft 4 ins by 1 ft 6 ins and 4 ft deep with piazza in front and rear, one story high 9 ft wide supported by 12 brick piers 1 ft 10 ins by 1 ft 2 ins and 3 ft deep with brick stoop and steps leading to front and two stacks of chimneys to house four fireplaces. The said building to be removed this distance as shown on Plan No. 2 and placed in like position by taking down chimneys and brick piers and placing them in the same manner as was standing on Plan No. 1 with the exception of the rear piazza and back steps which can be disposed with. A piazza to be built on each end to join in with front one, as shown in Plan No. 2. Building No. 1 with stoop and step put up in the same manner as now standing. The tops to be overlaid with cement. The main building after removal to be left in as substantial a condition as now standing with the additional work added thereto.



EXCAVATION I FOMO

Area A and B

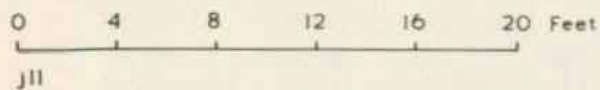


FIGURE 5. 19th and 20th Century Hospital Foundations
(That portion shown in gray pertains to
20th Century constructions.)

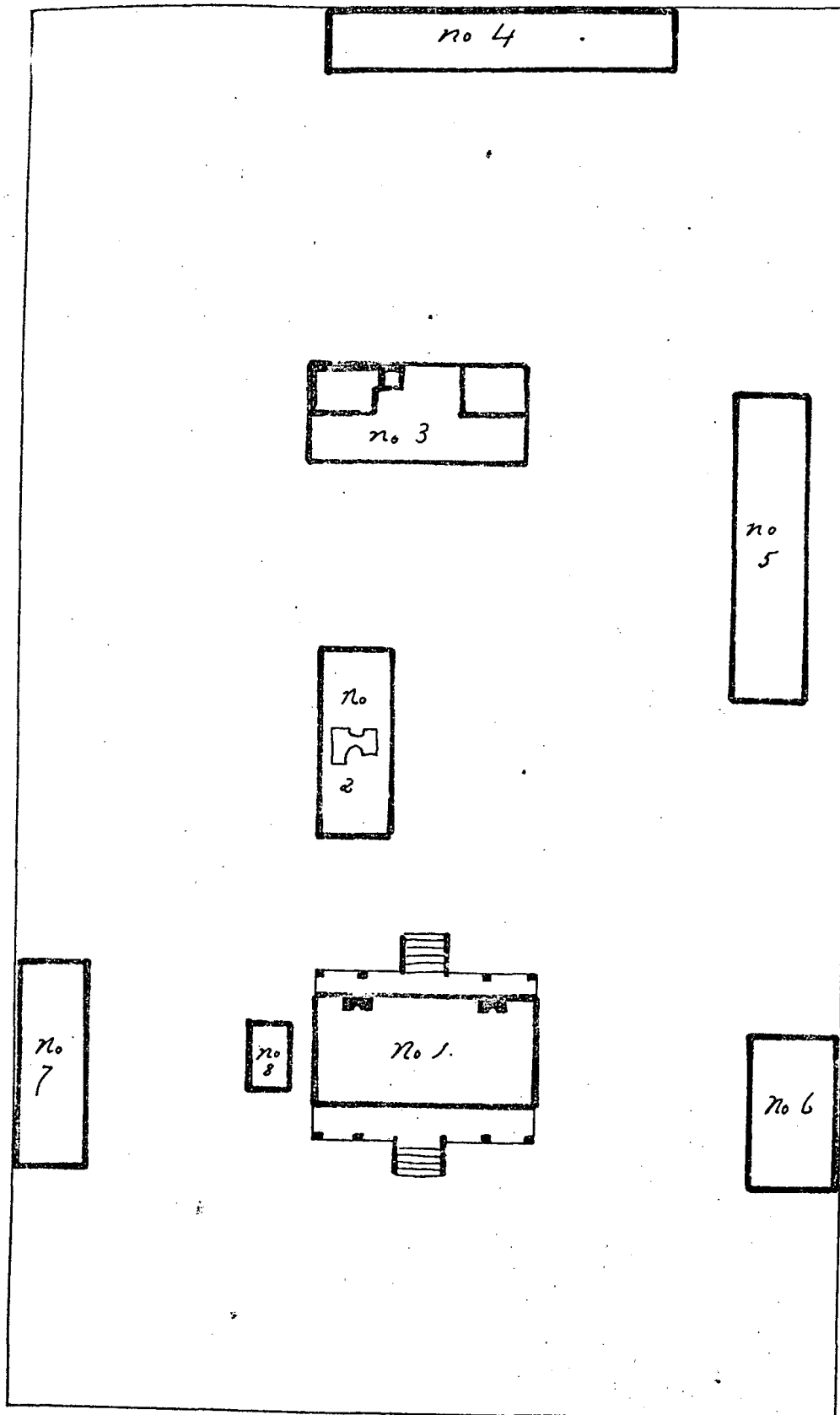
No. 2 - As designated on Plan No. 1 is the kitchen, a frame building 18 ft deep by 43 ft front, two stories high, elevated on 12 brick piers 2 ft 4 ins by 1 ft 6 ins and 3 ft deep with double stack of chimneys in the center as is shown in plans and four fireplaces with furnaces attached to ones on the first floor. The main building to be removed the distance as shown on Plan No. 2 by taking down chimneys and brick piers and placing them as now standing in Plan No. 1, in Plan No. 2 with the steps in front and all to be as at present after removal in a good and substantial condition. (See buildings on Plan No. 1.)

No. 3 - As designated on Plan No. 1 is the bakehouse, a frame building 50 ft front by 25 ft deep, one story high, elevated on 14 brick piers 2 ft 4 ins by 1 ft 6 ins and 3 ft deep with two ovens, 12 ft by 14 ft and 9 ft high from surface of ground with furnace attached to one as shown in plan with chimney to each. The main ovens, chimney and brick piers to be taken down and the building to be removed the distance as is shown on Plan No. 2 on the same elevation the brick piers to be put as also the ovens in manner as now standing and to be complete is every particular and fit to be used. (See building on Plan No. 1.)

No. 8 - As designated on Plan No. 1 is a cistern of brick 10 ft by 18 ft and 8 ft deep, 3 ft under the ground and 5 ft above ground built with the best quality of brick, 11-inch walls with pitched roof, even arch and cement inside and outside. The main cistern to be taken down and built up anew in manner on ground as shown by No. 8 on Plan No. 2. (See cistern of Plan No. 1.)

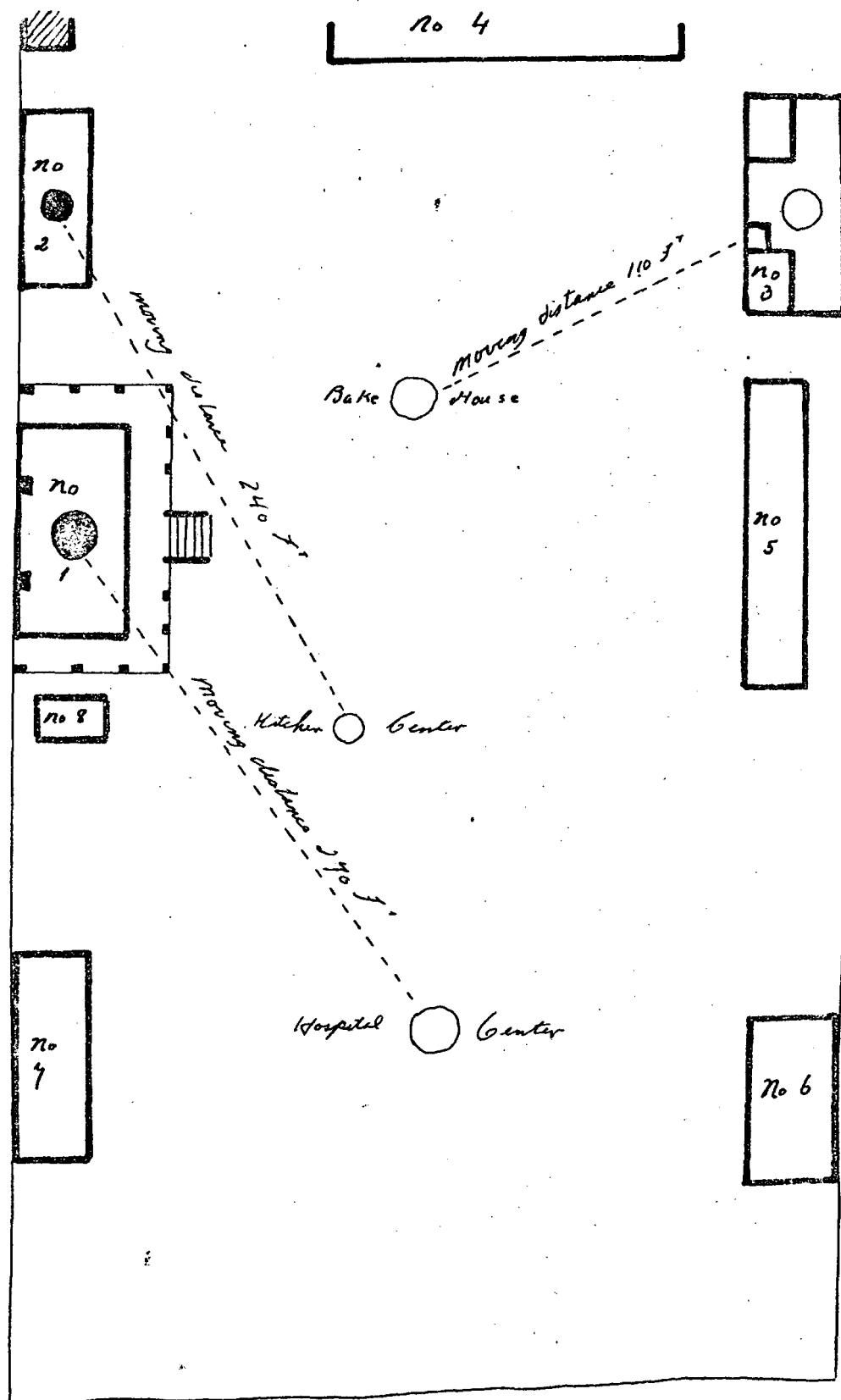
Materials for the masons' and carpenters' work to be of the best quality and the work expected in the best workmanlike manner - all the old bricks and lumber that may be taken down to be used in the repairs and alterations so far as the items are found sound and good. The lumber must be free from sap, rot or any other affect - the brick, lime, sand and cement to be of the best quality. The materials for removing the buildings such as timbers, rigging, rollers, screws, blocking, etc., will be furnished by the U.S. Also the laborers for blocking of and conveying the said buildings to their respective locations as marked on Plan No. 2. All the labor and materials to be furnished by the contractor or contractors as within specifications.

(Captain B. B. Myers)



Scale of Building to be moved 300' to 1 1/2 inch

- Front -
Plan No. 1

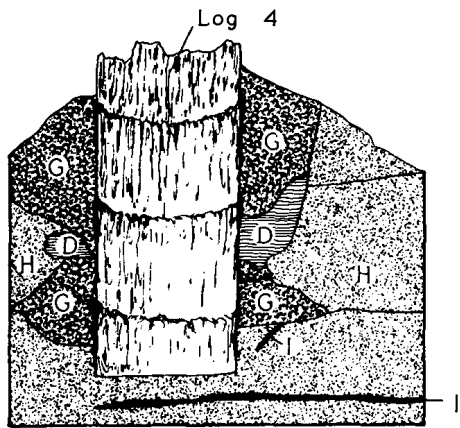
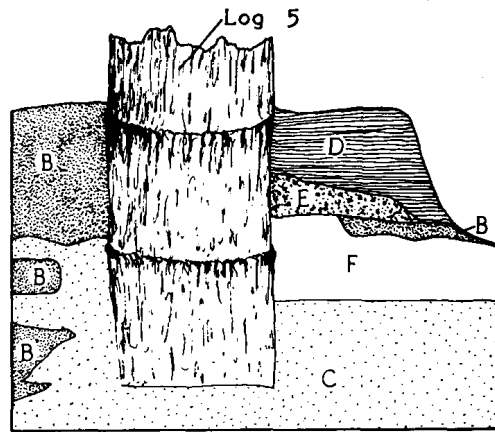
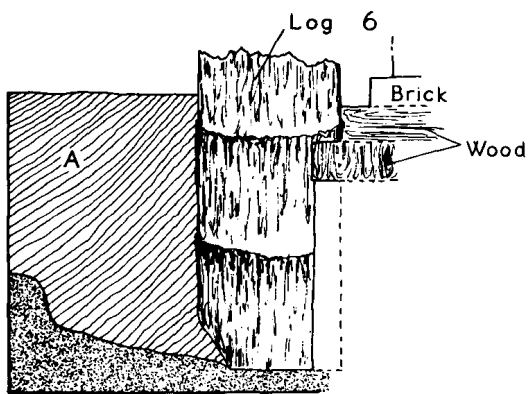


— Front —
Plan No 2

The pilings of this hospital were recorded and subsequently removed. The lumber was saved and is currently housed at Fort Moultrie. In removing these constructions the archeologists located a palmetto stump. Further excavation (level 3) eventually revealed four substantial palmetto post butts averaging 3 feet long and 8 inches in diameter. These were resting in a vertical position with three fragments of palmetto logs resting at a 45° angle to them (Figure 6).

A baffling and discouraging problem remained; no other cultural materials were recovered. It could be seen in the profile that these posts had been deliberately set but no associations could be found. Excavations continued but to no avail as no cultural debris was recovered. It was concluded that they could represent a portion of an abatis located behind the unfinished Moultrie I to afford some protection in the event of a British attack from the rear. Excavation 6 (Figure 7) was an extension of Excavation 1 and undertaken primarily to provide the archeologists with additional information concerning the beams located beneath the hospital. Time permitted us to enlarge this operation so that the combined excavations represented the entire area of the new visitor center.

Excavation 6 provided no evidence which would support Revolutionary War activity. The majority of our time was spent "recovering" and removing slabs of concrete, sheet metal and bricks. A second level was excavated which produced meager cultural debris, the majority of which was white soft paste earthenware with a blue transfer or annular pattern. Lesser quantities of broken glass and corroded metal were recovered.



- | | |
|--|-------------------------------------|
| | A Dark Mottled Brown-Gray |
| | B Dark Gray |
| | C Light Gray |
| | D White-Gray |
| | E Yellow |
| | F White |
| | G Yellow-Brown-Gray / White Mottled |
| | H Yellow-Gray Streaked |
| | I Brown Lens |

FOMO
Profiles
Excavation 1B - Level 3

0 1 2 3 FEET

FIGURE 6. Profiles of Palmetto Stumps in Excavation 1

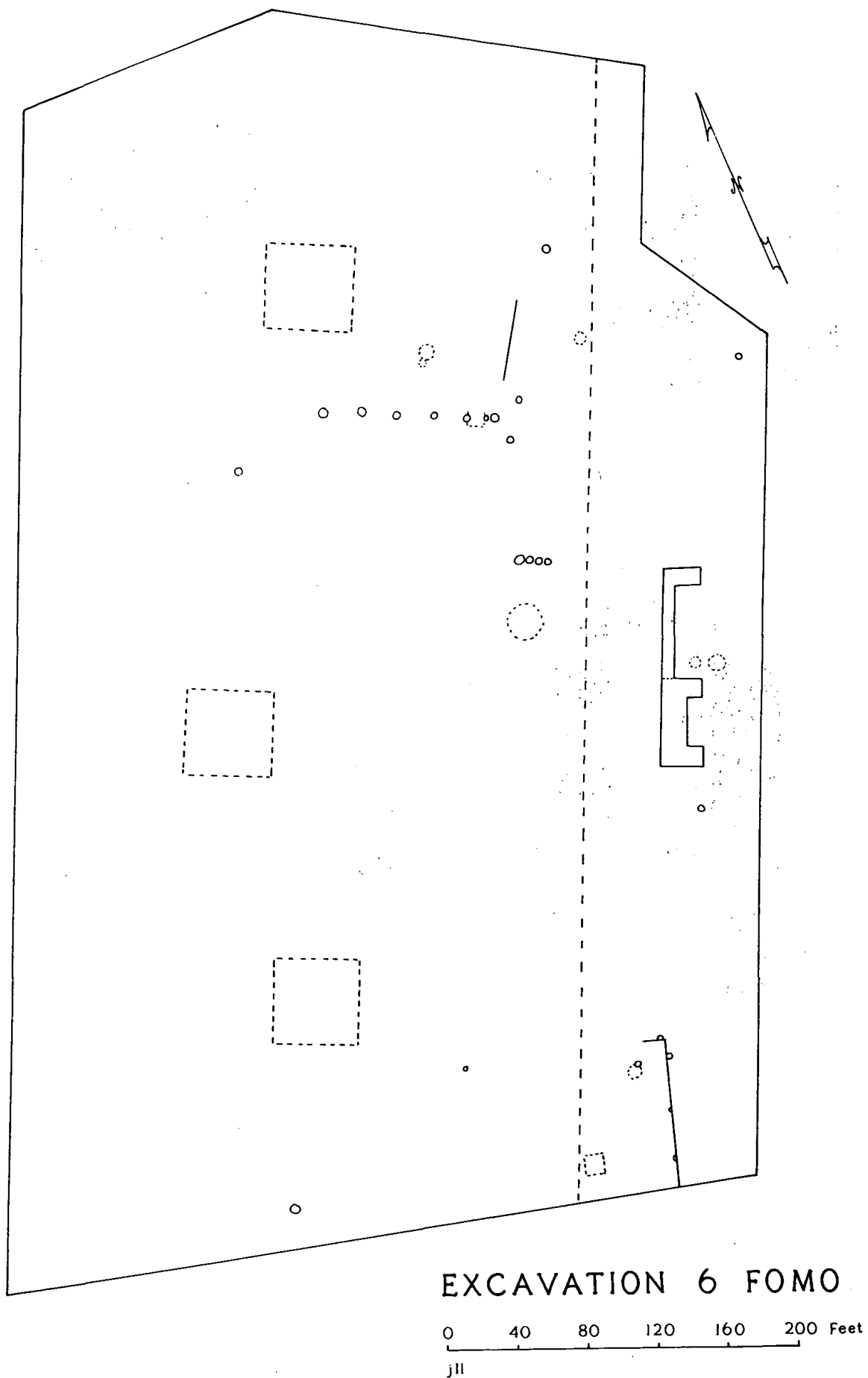


FIGURE 7. Excavation 6

Three square stains were located (Figure 7) which appeared to have at one time contained some form of construction. However, these had been removed and the holes filled in with sterile gray sand. Several post mold stains (Figure 7) were located. These were excavated but provided no artifacts. A few small planks supported by pegs were also found. These were 1 x 4 pine boards, 8 feet long; no information was recovered which would suggest the nature of their function.

Excavations 2 and 3

Excavation 3 was undertaken to recover additional information through expanded testing into the extent, shape and construction of the northeast bastion timbers of Fort Moultrie #1 postulated by Stan South (South 1974). These timbers were relocated and subsequently followed out. In time two parallel rows of squared, hewn timbers of Southern Pine (R. B. Miller, Center for Wood Anatomy Research) were exposed. The easternmost set was 65 feet in length and consisted of two lapped beams (Figure 8). The westernmost timbers, 25 feet away, were a series of five lapped or notched beams forming three angles (Figure 9). Their entire length totaled 179 feet.³

The excavation of the 5 feet of overburden which covered the timbers produced no significant cultural material. All artifacts recovered could be assigned to periods dealing with the Civil War or later. Modern beer and soft drink bottles, pop tops, metal wire and round nails were recovered in large quantities. Mixed with this material were small amounts of earthenware and stoneware.

EXCAVATION 3 FOMO

Detail of Pine Beam $\frac{1}{2}$ Lap

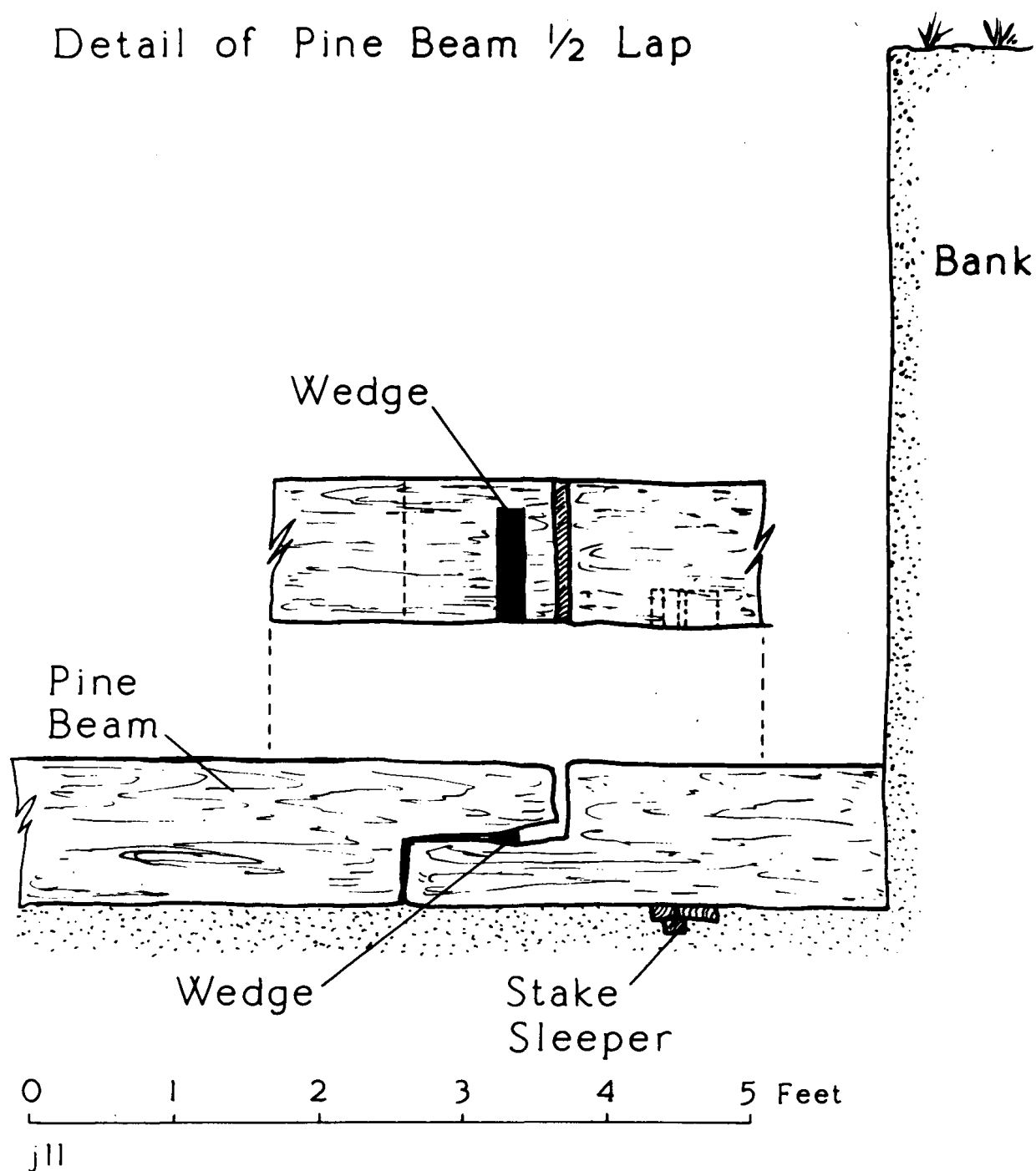


FIGURE 8. Detail of Beam Half Lap



FIGURE 9. Detail of Notched Beam in Excavation 3

It is interesting to note that no cultural materials were located in association with these timbers which could be assigned to the Revolutionary War. The only material recovered near the beams was a few fragments of white stoneware and an underglazed fragment of polychrome pearlware. As more and more of the timbers were exposed without recovering Revolutionary War material, apprehension as to their function began to build up; after completely exposing the beams a number of points were raised:

1. Did these beams really represent a portion of Moultrie I?
2. Why is there no cross-bracing between the beams?
3. Why are the beams not pinned together?
4. Why is there no foundation work or builders trench?
5. No Revolutionary War materials were located in association with the construction.
6. The northernmost end of the east timber has not been hewn but is rather the tap root of a tree.
7. The configuration of the construction does not conform with any explanations as to how the bastions were to have looked.

This posed a dilemma. If this was not a portion of Moultrie I, what was it? A series of letters written by Lt. Col. James Moncrief, a British officer, provided us with a plausible solution. Excerpts from his letters, written between March of 1781 and April of 1782, are presented below:

The ruinous state of Fort Arbuthnot must be an object of some attention in the course of next year, for which I shall await Lord Cornwallis' directions (Charles Town, 18th March, 1781).

Fort Arbuthnot is most likely Moultrie I. The name apparently honors the British admiral whose forces captured Fort Moultrie.

The ruinous state of Fort Arbuthnot which has been originally formed of materials not at all permanent has obliged me to begin another work at that island for the security of the harbor which will prevent a Naval force from lying at anchor between that and the Island of Shoots Folly and will be the means of retarding the operations of an enemy against this place (Charles Town, 6th August, 1781).

The ruinous state of Fort Arbuthnot and its great distance from Shoots Folly has obliged me to begin a closed work upon the nearest point of Sullivan's Island, which will effectually prevent shipping from lying at anchor in any part of the harbor between that and the Island of Shoots Folly and will be a great security to the old fort (Charles Town, 30th September, 1781).

Likewise preparing materials for a new fort upon Sullivan's Island, in room /?/ of Fort Arbuthnot, which will not stand many months longer (Charles Town, 13th March, 1782).

The whole of the works expressed in this plan are now in a state of defense, excepting a new fort which has lately been traced out upon Sullivan's Island a little to the Eastward of Fort Arbuthnot /sic/, which will be in ruins before this work can be completed (Charles Town, 2d April, 1782).

The British were never to finish this second work as they abandoned Charles Town on December 14, 1782 just eight months after Moncrief's last correspondence indicating that the fort had been "traced" out. On October 6, 1783 a fierce tornado swept through the Charles Town area and devastated the remains of Fort Moultrie (alias Fort Arbuthnot).

It is felt that the remains of Moultrie are not represented by these beams but rather the beginnings of the British work described by James Moncrief (Figure 10). It appears that little work was done; the timbers were not completely hewn nor were they pegged together. This would suggest that the construction was abandoned.

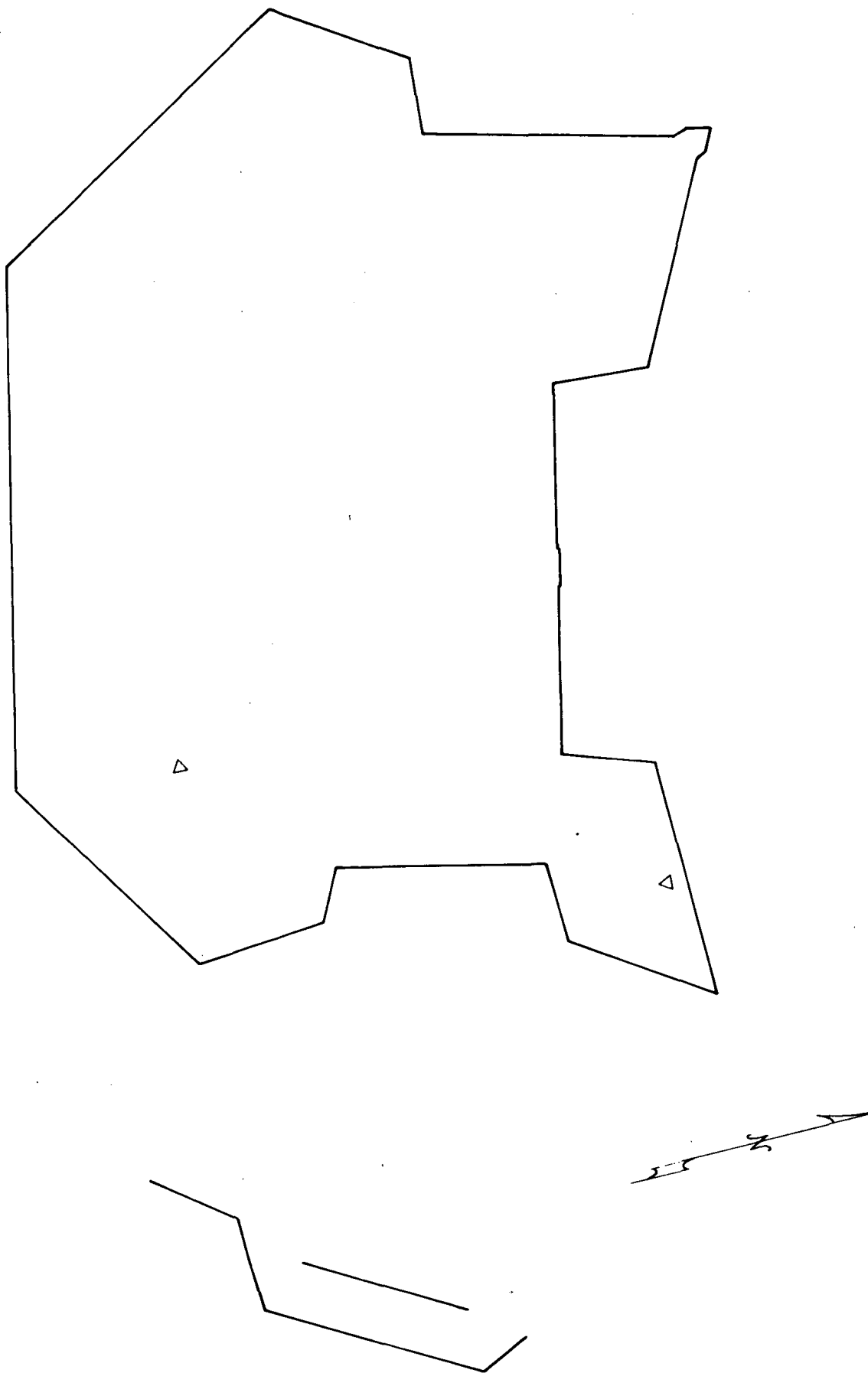


FIGURE 10. Outline of Moultrie 3 and Beam Construction to the East, thought to be Moncrief's Fort.

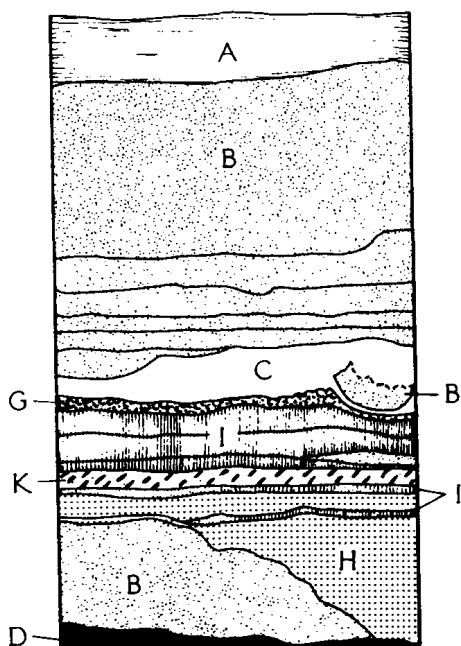
Excavation 2 was done in conjunction with 3 in an effort to locate the north and east curtain walls of the northeast bastion of Moultrie. Again there was 3 feet of windblown sand to be removed before any cultural debris was located (Figure 11). At this point a large wooden beam was exposed in the northeast portion of the test. It was a sore disappointment to discover that this was a protective cover for power cables leading to battery Jasper. Excavations were expanded in hope of locating earlier materials. However, the principal object found was a modern drainpipe utilized by the city (Figure 12).

Continued excavation revealed a portion of the Civil War Abatis discovered by South the previous summer (South 1974:312). Testing in the area around this construction produced several soil features; excavation of them did not add to our knowledge of the area and the cultural material can be assigned to the period of the Civil War or later.

Excavation 4

This test (Figure 13) was a trench 5 feet wide dug at the north end of the parade to determine if any of the foundations of the buildings lining the edge of the parade were intact and to see if there was any evidence of either the canal or encampment of the Revolutionary War period. We had assumed that the area marked "Burying Ground" referred to the Dyer plot which was certified as being moved in 1844 (Appendix A). The first coffin was found partially under the south wall approximately 55 feet west of the east end of the trench. A second coffin was found approximately 58 feet west and under the

North Wall Profile
Excavation 2 A



FOMO
Soil Profiles

East Face Profile
Excavation 1B

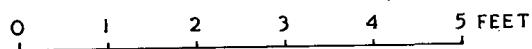
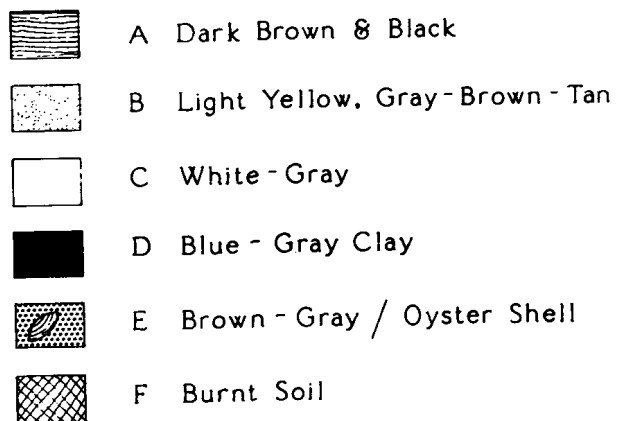
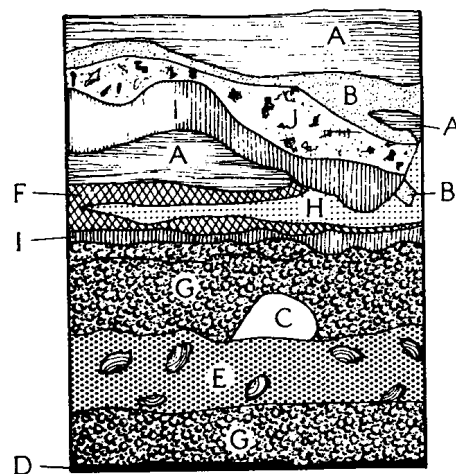


FIGURE 11. Soil Profiles in Excavation 2

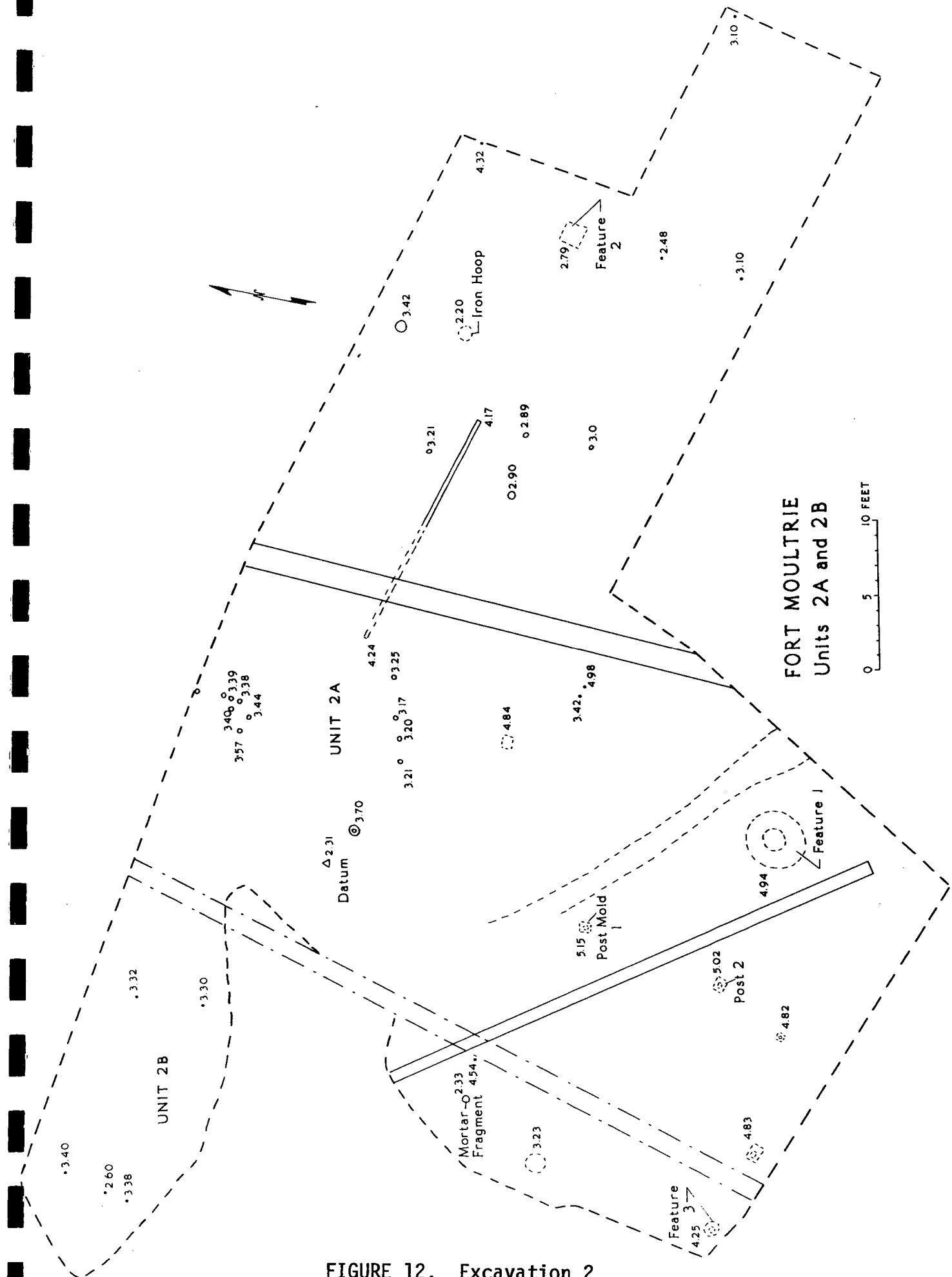
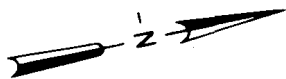
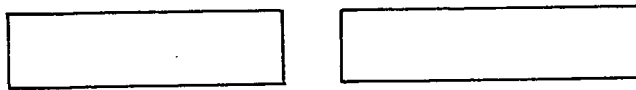
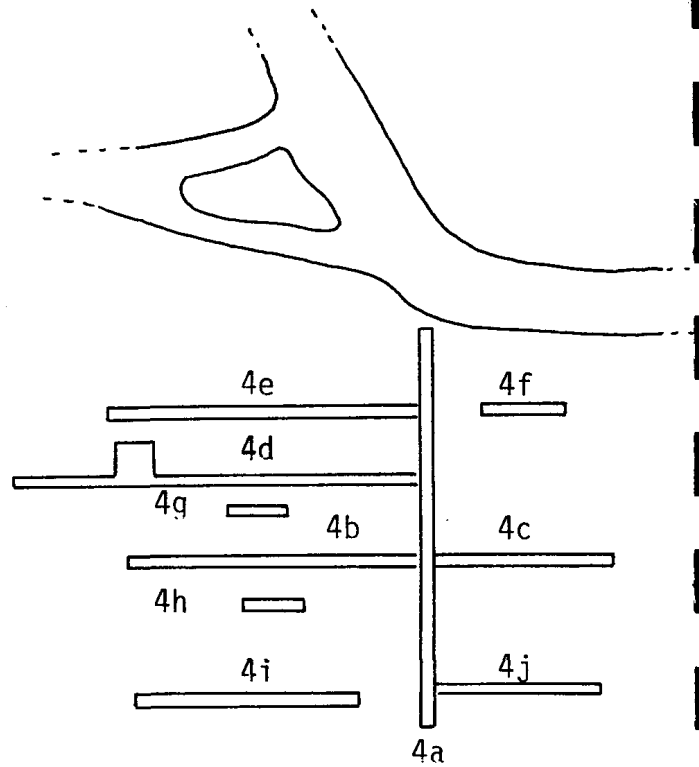


FIGURE 12. Excavation 2



4k



EXCAVATION 4
CEMETARY



FIGURE 13. Excavation 4

north wall of the trench. No other coffins were found in the remaining 75 feet of the trench west of the second coffin.

Excavation 4C was a trench running from 4A at the location of the second coffin, north 53 feet. There was no indication of any burials in this area.

Excavation 4B was a trench extending 86 feet south from 4A at the location of the first coffin. Fifteen coffins of adults and children were uncovered over a distance of 60 feet. The coffins extended either into one wall or the other of the trench, suggesting a double row of graves with paths between the double rows.

Two shapes of coffins were used: rectangular and hexagonal. There did not appear to be any temporal difference between the two shapes. We could not determine whether sex of the deceased was involved in the shape of the coffin, but it is highly unlikely. The coffins were held together by dovetail joints rather than nails. The bottoms and lids had beveled edges to make a flush surface with side boards. One, two and three piece lids were observed for the hexagonal coffins. The multi-piece lids were glued together rather than nailed together with cross pieces.

Three coffins were investigated; one had the lid torn off by the backhoe during trenching, one was partially destroyed by land filling and building demolition in the 1950's and the third was for comparative purposes. An attempt was made to investigate a child's coffin,

but the water table was too high. The only cultural items remaining were portions of shoes found in the coffin that were partially destroyed before. All of the coffins had wood shavings in the bottom which were used to cushion the body (Jack Walker, personal communication).

The first two coffins investigated were in unit 4A. Both were hexagonal in shape and had quite similar dimensions. Coffin #1, under the south wall of 4A, was 79.5 inches long, 11 inches wide at foot, 12.25 inches wide at head, 22 inches maximum width and 11.5 inches deep; coffin #2, under the north wall of 4A, was 78.75 inches long, 13.5 inches wide at the foot, 15.5 inches wide at the head, 21 inches maximum width and 11 inches deep. The third coffin was rectangular, 21.5 inches wide, but badly disturbed for accurate measurements on the length. It was 76 feet south of trench 4A.

Burial #3 may not have been contemporaneous with the earlier cemetery as the shoe soles indicate post 1850 manufacturing practices. In 1858 there was a Yellow Fever epidemic from which 40 soldiers of the garrison died (Bearss 1968, p. 123). The dead were quickly placed in rough wooden coffins and buried in shallow graves (Bearss 1968, p. 123). There is no location given for the post cemetery. Bearss (personal communication) does not think it would have been on the parade ground, even though the grave was within 100 feet of the post hospital, because the soldiers would have vigorously objected to drilling in or near a cemetery (Bearss, personal communication).

This burial may have been a casualty of the Civil War and had been fortuitously placed near the old cemetery.

Five other coffins, all badly disturbed, were in trench 4D. They were all south of burial #3 over a distance of 26 feet. The razing of the hospital broke up the coffins and scattered their contents. Two were hexagonal, two were rectangular and one was indeterminable. No artifacts were found in the burials to enable dating.

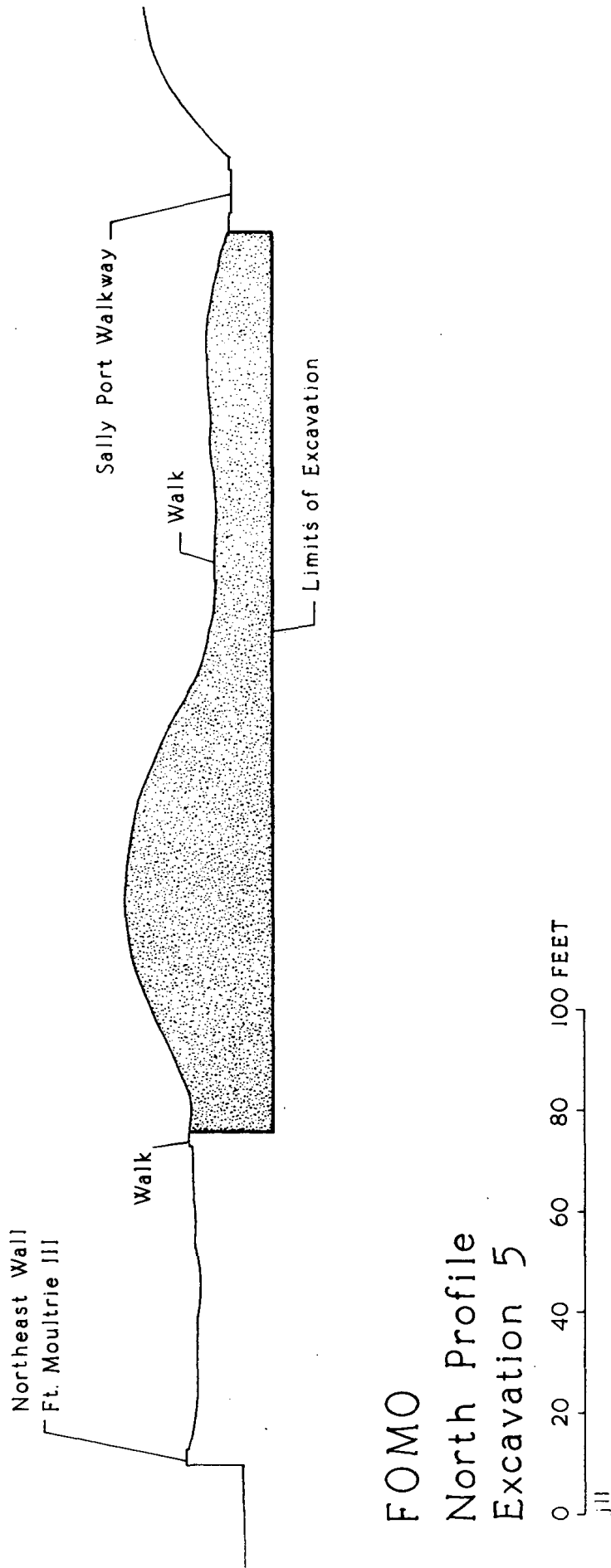
All the graves were shallow as the water table was quite high both then and now. The average depth of the coffins was 2.16 feet below grade. The tides fluctuated at 2.5 feet \pm sea level, thus the coffins were constantly below water.

Excavation 5

Excavation 5 (Figure 14) was located within the confines of Fort Moultrie III. The development master plan of the park calls for the fort to reflect the major eras of sea coastal fortifications and artillery. The northwest bastion and west half of the parade are to be restored to the 1808-1840 period. The Civil War and post war modifications had destroyed the west barracks, parade wall, terreplein and changed the parade ground level and configuration.

The brick barracks were completed between 1809 and 1811 (Bearss 1968, pp. 24-25). It was in continuous use with renovations and alterations until 1863 when damage from Union bombardments made habitation impossible.

By 1821 the window sashes and door jambs had rotted and the upper story was badly deteriorated (Bearss 1968, p. 38). It was not until



FOMO North Profile Excavation 5

FIGURE 14. Excavation 5 (Shaded Area was Portion Excavated)

1829 that the barracks were refurbished, piazza built onto the front, interior walls replastered and all walls yellow-washed (Bearss 1968, p. 39). The next major change for the barracks was requested in 1843 by Captain Myers to have the first story brick floors replaced by wooden floors and fireplaces rebuilt (Bearss 1968, p. 51). There are no records to document when the modifications were made except that a reference in 1854 referred only to the pavement under the piazza as being brick (Bearss 1968, pp. 59-61).

The barracks suffered considerable damage from artillery fire returned by Fort Sumter on April 12-13, 1861 (Bearss 1968, pp. 166-167). Photographs dated April 16, 1861 that appeared in Harpers Weekly show the damage but the buildings appeared to be inhabitable. On August 17, 1863 General P. G. T. Beauregard ordered the west barracks removed to protect the west batteries from flying debris from Union bombardment (Bearss 1968, pp. 170-171).

In February of 1872 extensive modifications were begun on Fort Moultrie to repair war damages and to incorporate new technological advances in architectural building materials and artillery developed during the Civil War. A wooden bombproof and the foundations of the west barracks were reportedly removed (Bearss 1968, p. 191). Aggregate material for the gun platforms of the newer and larger cannons come from the razing of the brick parade wall (Bearss 1968, p. 192). In place of the parade wall, sand was banked from the terreplein down to the parade ground covering the site of the barracks.

The final modifications that affected the area of excavation were made between 1898 and 1901 when mounts for rapid-fire guns and the guns replaced the obsolete large caliber muzzle loading guns. Two 15-inch Rodmans, four 10-inch columbiads, two 8-inch siege howitzers, four 10-inch mortars and two 10-inch Rodmans were among the obsolete weapons that were sold or were to be destroyed. Some of the weapons were sold on July 16, 1900 and the buyer was to remove them from the reservation (Bearss 1968, p. 265). After the new gun batteries and associated magazines were constructed more sand was brought into the parade to protect the magazines.

As a result of all the filling in the parade ground, the 1808 surface level from which construction began was over three below grade in the center of the fort and over 14 feet near the curtain wall. The primary objectives of this unit were to ascertain the original parade level, locate the west barracks and parade wall (both reportedly removed in total) and to test a hypothesis proposed by Architect John Garner that the Fort Moultrie II west barracks were built on or near the Fort Moultrie III barracks which were originally built in 1784 as a pest house on the foundations of the former officers barracks of Fort Moultrie I. Locating the foundations of the first barracks would help define the location of Fort Moultrie I.

Removal of the overburden inside the fort was more complicated than other areas because the sally port (only entrance) was too small to permit entry of adequate capacity machines necessary for the task.

Overburden had to be removed from an area approximately 70 feet wide, 150 feet long and an average depth of 10 feet. Our schedule allowed 2 weeks time for the overburden removal by two D-11 bulldozers, a D-4 bulldozer and a backhoe. A sand ramp was built on the outside of the southwest curtain for entry and exit of the machines. Even with these four earth-moving machines working simultaneously, the archeological crew at times was delayed because an area was still deeply buried.

On the first day of overburden removal the backhoe discovered five cannon tubes buried approximately 2 to 3 feet below grade. Four tubes, two 10-inch Parrotts and two 10-inch Rodmans pointing south, were resting on a decayed wood platform. The other tube, a 15-inch Rodman, was resting on sand and concrete rubble facing west. These tubes undoubtedly were among those sold in 1900 but never claimed by the buyer. When they were dismantled in 1900 they were stacked neatly on the parade ground and the army probably found it more expedient to cover them over than to cart them away. The concrete rubble was from the removal of the old gun mounts which was also easier to dispose of by covering over with sand than by carting away. The tubes were approximately 0.5 to 1.0 foot above the Civil War parade level. The lack of proper equipment and space made this unusual discovery a major hindrance to the progress of the excavation. Our modern technology has produced powerful machines which the artillery corp in 1865-1880 did not possess, but the amount of human effort put into the removal of these tubes by our crew was tremendous. A 40-ton capacity crane

plus a dozen workers with shovels and planks labored 8 hours to drag and lift the four smaller tubes. It took three bulldozers and block and tackled to move the large tube.²

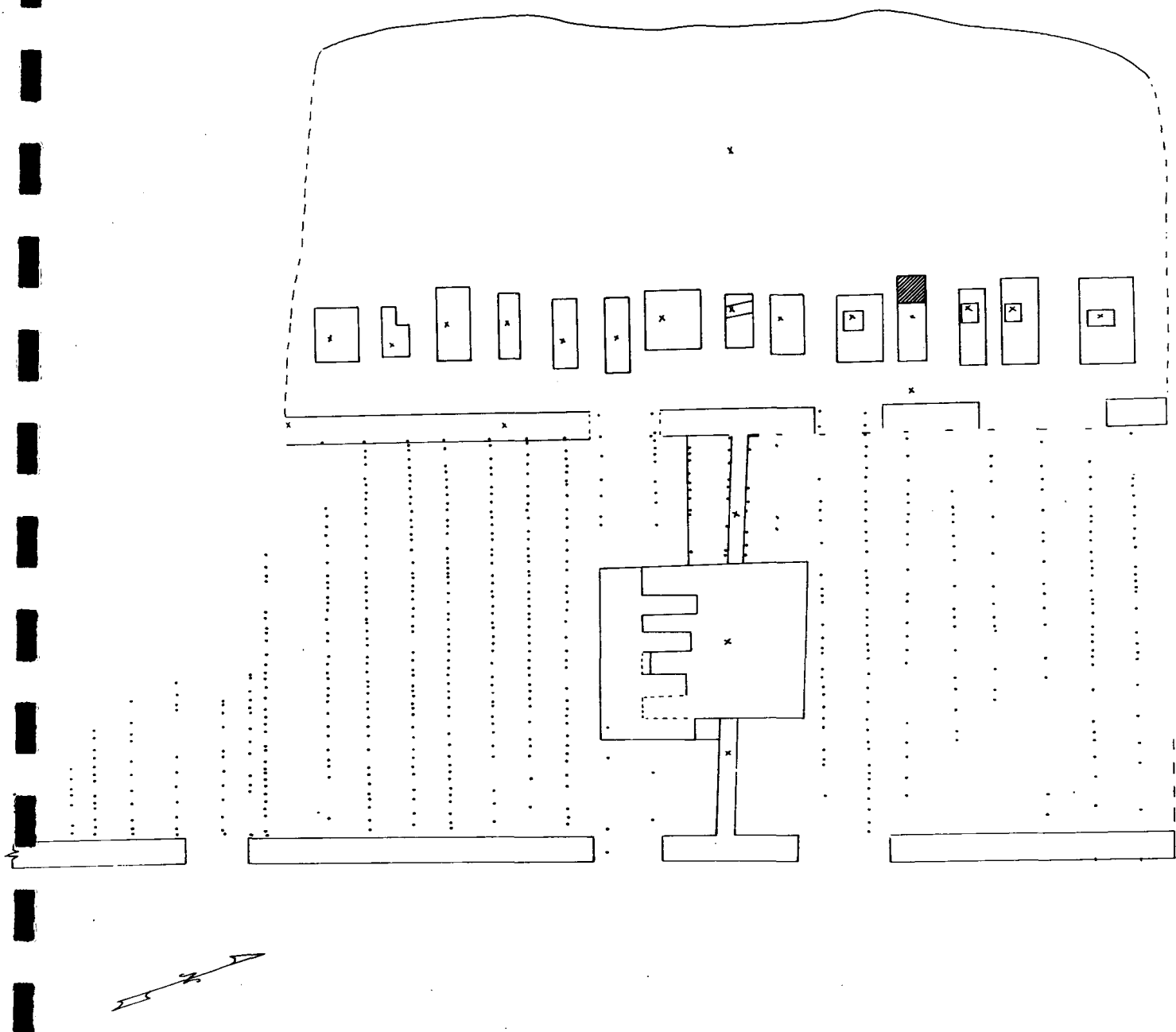
The parade level during and immediately after the Civil War was easily discernable. A crushed shell and natural sand surface made up the central parade. In front of each barracks was a brick walk that was part of the piazza.

Flower gardens were planted in a 10- to 11-foot bed between the piazza and the parade ground. The level of the flower bed was just 1 to 2 inches below the brick walk and up to 3 inches above the parade level. Bricks set on end separated the garden from the parade ground.

The area of excavation 5A was taken down to sterile in hopes of finding evidence of Fort Moultrie I. There were numerous intrusions from the 1865 level (Figure 15, map of units B-C-D) but there was no evidence of the 1776-1781 period of occupation. Sterile soil was a dark gray sand with occasional bits of shell and clusters of reed stems.

The brick walk under the piazza was 10 feet wide and ran the length of the building. Outside of each original west barracks entry was a 4-inch thick slab of silt stone that was approximately the same width as the entry and extended 2.5 to 2.75 feet out. Doors added at later building modifications did not have these slabs.

Brick pillars supporting the outside edge of the second story porch and porch roof were approximately 1.5 feet square. To support the



FORT MOULTRIE
UNIT 5 B-C-D

0 5 10
FEET

FIGURE 15. Excavation 5 - Units B-C-D

downward pressure that these columns exerted, a hard packed sand and lime mortar base was laid down approximately 1 inch lower than walk level. The walk was laid on the natural sand surface.

The foundation of the brick barracks was not uniform. In Unit 5C there was a sand and lime mortar base 0.5 to 0.75 inch thick, while in 5B the wall was laid directly on the sand surface. The wall began five courses below the walk level. On the interior side a 4- to 6-inch wide ledge provided support for the floor joists. The joists were 2 inches by 6 inches and 20 feet long, except for the joists in the doorways which were 2 inches by 4 inches.

Originally the floor of the first story was brick. Six inches of clean sand was brought in to serve as fill below the floor; in spots sand and lime mortar was used as a base. When the rising water table made the floor constantly moist, a wood floor replaced the brick one. In 5B the brick floor was completely removed and 2- by 6-inch joists were installed to support the wood floor. Only enough bricks were removed in 5C to install the joists. The joists were spaced 2 feet on centers and there the flooring rails were spaced approximately 3 inches apart. There was only wood mold left from the floor boards so no dimensions could be taken.

The walls were approximately 1 foot thick with plaster on the interior and exterior. Two distinct layers were on the interior of the walls; the inner layer was approximately 3/8 inch thick with a grayish painted surface and the outer layer was approximately 1/4 inch thick with at

least two coats of paint. One paint was yellowish in color and the other gray.

Another door was opened to the parade from 5B before the second layer of plaster was added. The partition wall between 5B and 5C was not square to the exterior walls; it formed an 87° angle with the west wall and a 93° angle with the east wall. It was 8 inches wide and was bonded to the exterior walls.

The back-to-back fireplaces were for entirely different functions; the larger one in 5B was for cooking and the one in 5C was for heating. Company kitchens were located on the first floor of the company's barracks. Each kitchen had a brick stove, which was capable of handling three kettles. The stove was divided into three equal compartments, each with its own hearth and flue. In 1854 the stoves were to be dismantled and iron stoves were to replace them (Bearss 1968, p. 63). There is no indication as to whether the change took place, but the foundation of the brick stove still remains. Wood planks, 2 by 10 inches, were used as a base for the fireplace. A 1-inch layer of sand and lime mortar separated the planks from the base course of bricks. Each compartment was 1 foot wide and 2.5 feet deep separated by either an 8-inch or 12-inch brick partition. The top of the stove was probably about 2.5 feet high. The hearth extended approximately 20 inches out from the front of the stove.

The other hearth was only 2.5 feet in total depth. Since the wing walls were missing the width of the hearth was not measurable.

Between the rear of the barracks and the parade wall was another brick walk, 30 feet wide. In 1863 the Confederate Forces completed construction of a 175 feet long, 30 feet wide bombproof over this walk (Bearss 1968, pp. 176 and 191). The holes in the walk, approximately 3 to 6 feet from the building, were made for support pillars of the bombproof. In 1872 major modifications were made to incorporate new weapons systems and to improve the defenses of the fort. The terreplein, parade wall and barracks were removed as part of this renovation project (Bearss 1968, p. 191).

Contrary to the engineer's reports to his superior, the demolition activities did not remove all structural foundations, rather everything was razed to within a foot of the parade level and covered over with sand. Approximately 15 feet, the west half, of the walk had been removed.

The parade wall was built on a double layer of 2-by 10-inch planks. The lower layer of wood ran with the length of the wall and the upper layer was perpendicular to the wall. On the inside face (west) of the parade wall the planks extended approximately 8 inches beyond the bricks but were flush with bricks on the outside face. Only three courses of bricks remained of the 4-foot-wide wall.

A small brick storage space was built under the terreplein. This also served as a counter fort to give horizontal support to the parade wall even though there were specifically designed counter forts for that purpose. The storage space was approximately 5 feet wide and

4 feet deep with 1.3-foot thick walls. A hard pack, but undulating, lime layer was the only floor level found in the space. It was approximately level with the top of the base course of bricks. The 8 to 10 inches of fill on top of this floor was the only concentration of artifacts recovered during the entire project. Artifacts ranged from square mold blown case bottles to blue transfer decorated iron stone plates. There is no record of where the fill was obtained. Entrance into the storage space was by an arched opening in the parade wall. The parade wall was not part of the 4- by 5-foot space. The door was probably slightly recessed. Artillery accoutrements were probably stored in this space as they would be near at hand; it was too damp to serve as magazines.

Excavation 7

An attempt was to be made, if time permitted, to locate the foundations of Moultrie II which were believed to exist in the low-lying area south of the present fort (Figure 2). An area was marked out where historical information suggested the fort might be found and excavations were initiated (Figure 2).

To our great dismay, ground water was encountered less than 1 foot beneath the surface. A series of well points were set down and several pumps were placed into the line in an effort to lower the table; much to our consternation, the water appeared to be rising! It was concluded after several futile attempts that it would not be possible to lower the water table in such a low area by the means available to us.

Our problems were most likely a function of three concurrent natural phenomena: the summer solstice, a full moon, and the abnormally high tides resulting from a hurricane further south.

The alternative was to locate Moultrie II by some means which did not require exposure. The outcome of these thoughts was a contract let to John D. Combes of the Institute of Archeology and Anthropology, University of South Carolina, Columbia, South Carolina, to undertake a soil resistivity study. Mr. Combes' report is presented in Appendix E of this manuscript.

Excavation 8

The discovery of timbers northeast of Moultrie III by South in 1973, which he hypothesized to be the remains of Moultrie I, led to their complete excavation (excavation 3) by the authors. Concurrent with excavation 3 was another test, excavation 7, which was positioned 60 feet to the southeast. This test was located well above the 1899 beachline (Figure 2); it was hoped that research in this area would reveal evidence of the re-entry for the postulated northeast bastion and adjoining curtain wall.

This test, approximately 80 by 35 by 7 feet proved to be a sore disappointment. No cultural material of any nature or period was recovered. The profile column exhibited only sterile homogeneous sands of windblown origin. Reluctantly, it was decided that the support systems required to lower the water table should be pulled and the excavation abandoned.

CONCLUSIONS

The remains of Fort Moultrie I were not discovered during the course of this project. Instead, the foundation timbers of a fort laid out by the British engineer, Lt. Col. James Moncrief were discovered by South in 1973 and full exposed during our excavations. South added a Hypothesis B to his report (South 1974: 88-92) when new archeological plus historical evidence was generated by us. The archeological evidence alone would have been sufficient to disprove South's Hypothesis A (Figure 16). The timbers did not form the east curtain and the flank and face of the north-east bastion as proposed by South (South 1974: 62-63). Instead, they formed the east curtain and the adjoining flanks and faces of the northwest and southwest bastions. This immediately disproves part of Hypothesis A and leads to a re-examination of the entire hypothesis. The archeological evidence does not suggest these timbers were part of the west wall of Fort Moultrie I because: the timbers were pine and not palmetto; there was no cross-bracing between the timbers to prevent spreading of the timbers when a vertical load was applied; the half-lap joints of the timber were not nailed or pinned together, suggesting incomplete construction; the only parallel set of timbers was along the curtain wall, the outer line along the bastions was never laid down and no foundation trench for the timbers was ever dug; the last timbers at either end of the structure were not squared off and a half-lap joint made to fit with the next timber which again indicated incomplete construction; there were no indications of any occupational surfaces near the timbers; and the only

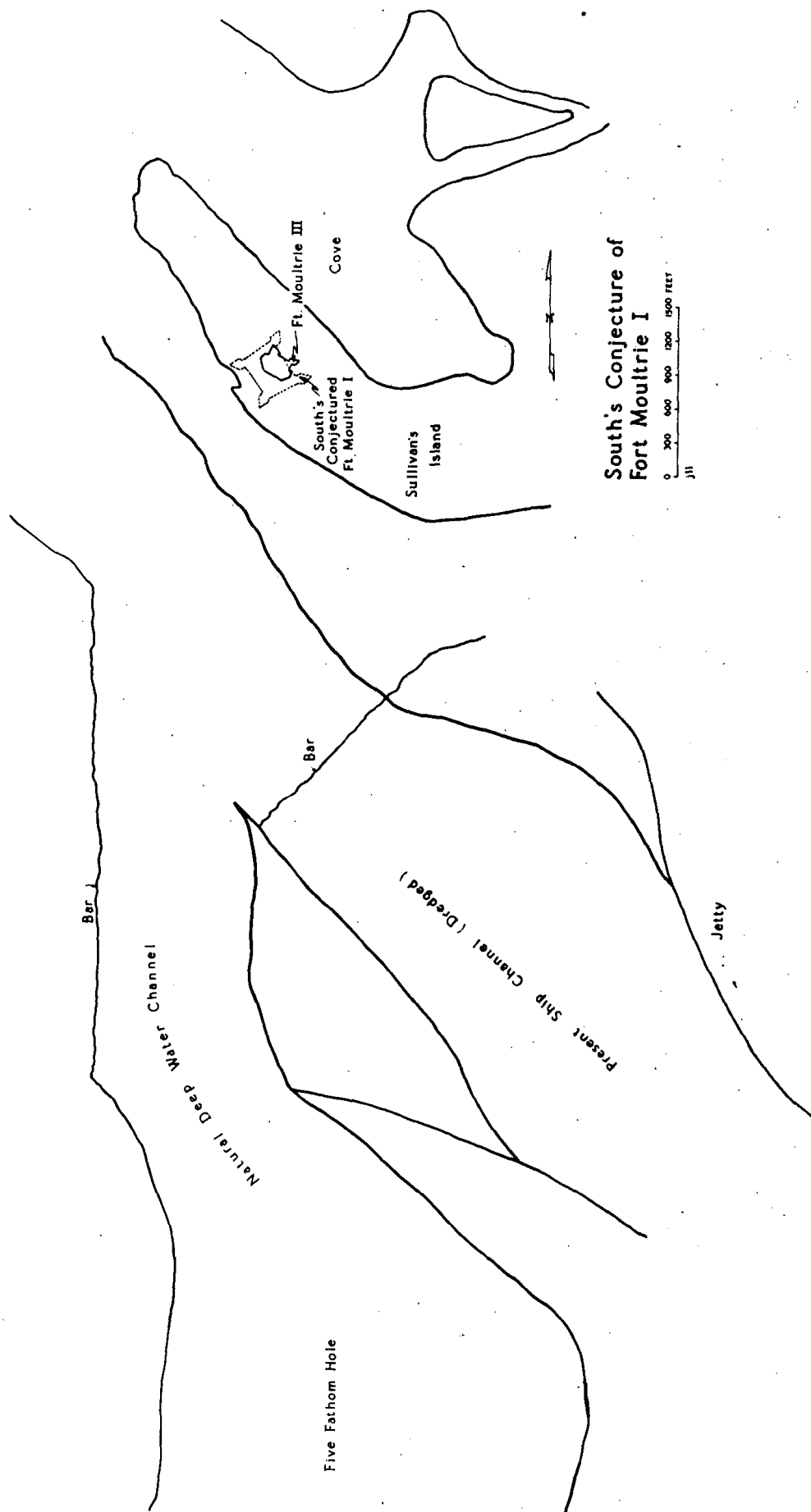


FIGURE 16. South's Conjecture of Fort Moultrie I

datable artifact found in the foundation trench was an under glaze polychrome pearlware which at present cannot be dated any earlier than 1780 (South 1974, personal communication).

The configuration of the structure would rule out a horn work or detached work associated with Fort Moultrie III (1808 to present). This narrows the time of construction between 1779 and 1808. The fort that Lt. Col. James Moncrief's letter of April 2, 1782 referred to is the best explanation for this structure.

Since the timbers do not belong to Fort Moultrie I, the location and orientation of the first fort is still open to speculation and has not definitely been tied down as suggested by South in his Hypothesis A. We suggest that the first fort was further south (closer to the water) than the existing fort and oriented in the same direction, i.e., the respective south walls were parallel or nearly so (Figure 17).

The most important factor in the alignment of the fort is to cover the ship channel. Aerial photographs and modern navigational charts clearly show the same dominate features that effected navigation until the present levy and channel were completed. South hypothesis has the north-south walls of the first fort oriented 27° east of the present fort's wall (South 1974: Figure 1) which are perpendicular to the axis of the ship channel. A shift of 27° away from perpendicular would mask the guns on the curtain wall and southeast bastion. The only guns that could be brought to bear would be those on the south face of the southwest bastion. By the time all guns could be brought to bear, the ship(s) would have a broadside unmasked taking away the advantage the fort would have.

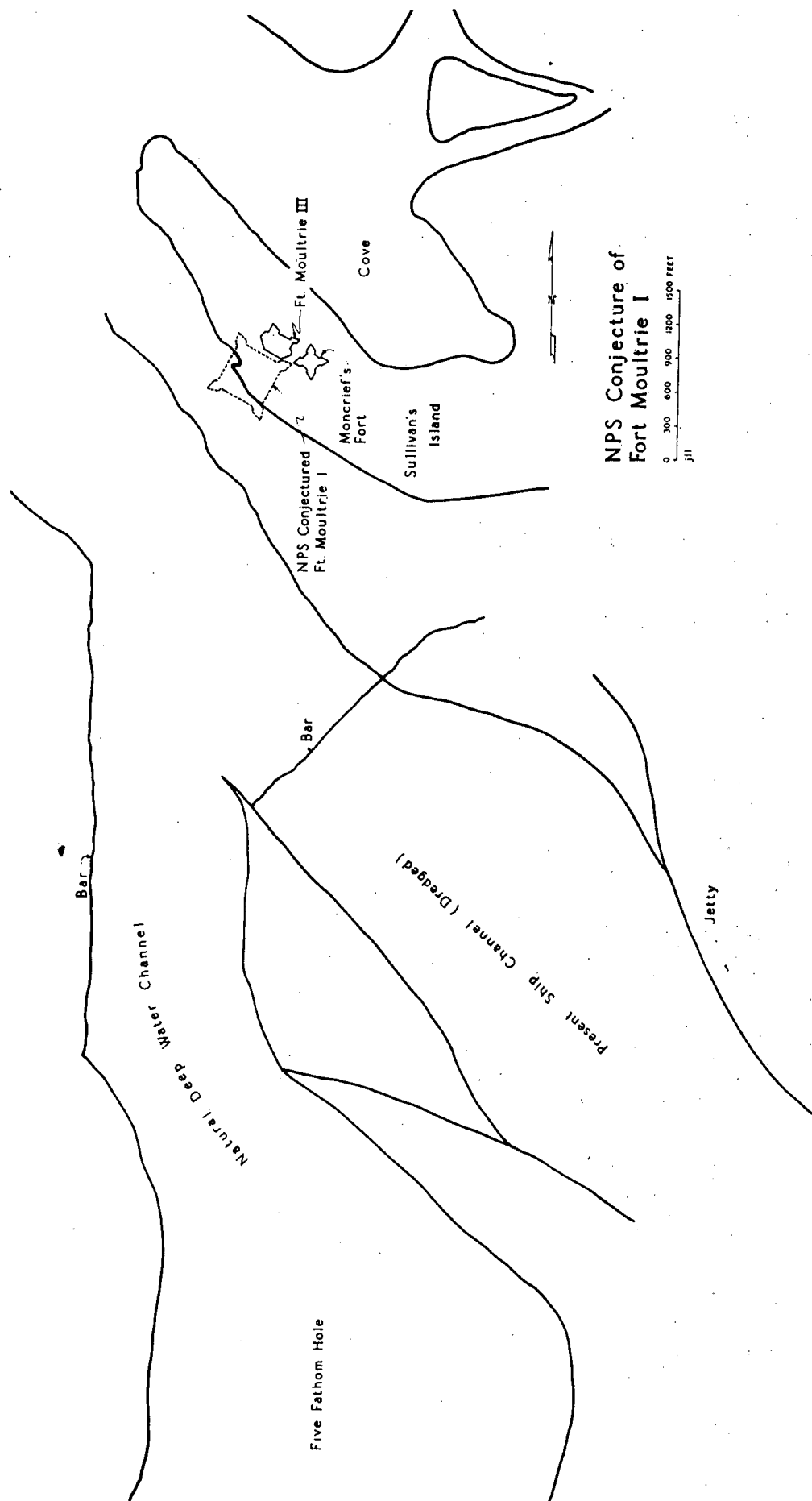


FIGURE 17. NPS Conjecture of Fort Moultrie I

Another reason for our hypothesis is that the British fort's west and south walls would be masked by the American fort. Eye witness accounts of the condition of the American fort from 1780-1784 varied considerably. Much of the variation could be attributed to the reason a witness had for documenting his observation. British Vice Admiral Marriot Arbuthnot described it as the strongest fortress of its size (Bearss 1968: 17). A British soldier described the fort "...the strongest Fort ever built by hands...it would be impossible to storm it; and none but cowardly Rascals would ever give up so strong a post." (Bearss 1968: 17). These two 1780 military accounts from an attacker's viewpoint give a more heroic atmosphere to their successful capture of an enemy stronghold. One year later the British engineer Lt. Col. James Moncrief pronounced the fort a derelict and was making plans to construct another. In 1784, on the anniversary of the repelling of the first British attempt on the fort, a Charleston resident remarked on the still apparent stoutness of the original works.

The conflict of interpretation of the last two men's accounts are understandable since one is military and the other civilian. All these men spoke with some truth; the fort was probably still a formidable structure to seize. The British were concerned with attack by either land or sea. To prevent the fort being enfiladed from the west flank again, the British constructed another work at the west end of the island. This fortification and one on Shootts Folly covered the cove behind the fort. There was no strong defense against a land attack; assaults could be made against the tips of the two northern

bastions. Another fort in the orientation of the one laid out by the British would strengthen the overall defense. The south and west walls would provide enfilading fire for the old forts north and east walls and reduce the possibility of attack against the northern bastions.

The condition of the American fort is important because of the fact that it masked the new fort from the sea. Between the time the new fort is completely armed and the old fort dismantled to unmask the sea batteries, the new fort would be vulnerable to sea attack. The second problem with the new fort being the main structure is the orientation of the south wall to the ship channel. It would have the same disadvantage as South's hypothesized fort.

The second reason for suggesting the fort was located further south was the lack of any occupational surface under the northwest bastion of the present fort. In May of 1975 the floor of the original 1808 magazine was removed so we were able to investigate below the structure. According to South's Figure 1 the entry was just north of this structure and the ground would have been subjected to heavy foot traffic and possibly vehicles also. There was no evidence of any activity.

The moat that South interprets as the fort's moat could also be a moat protecting the garrison bivouacked behind the fort prior to its completion. The American army was admired by many British officers for the ability and propensity to quickly erect earthworks and moats

at every opportunity. Troops were quartered behind the fort long after the battle of June 28, 1776; Col. Moultrie gave orders not to destroy the huts as the 2nd South Carolina Regiment would use them.

The southern limit of the garbage dump was interpreted by South to be constructed by the wall of the northwest bastion. The area of garbage could have been limited by the parapet of the glacis instead of the bastion wall.

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POSTSCRIPT

Subsequent Investigations at Fort Moultrie

Subsequent investigations by Service archeologists, Ehrenhard and Hsu in particular, have failed to provide convincing data on the location of the first fort.

In 1974 major excavations (Ehrenhard and Hsu) to uncover portions of the 1808 period parade level within the present fort failed to document and provide evidence that might be related to the first fort even though those excavations were carried below parade level where possible. Excavations in 1975 by Ehrenhard in the area of the old storage magazine yielded no pertinent data. Ehrenhard continued his excavations outside the present fort in the area of the postern gate; portions of Eliason's Palisade (1833) were uncovered together with a remnant of a crib-like structure unrelated to the palisade. The latter construction could neither be identified nor dated. Also in 1975 Archeologists Walker and Prokopetz provided monitoring and testing in a trench excavated in Middle Street entirely traversing the fort tract. The trench failed to reveal any data clearly related to Fort Moultrie I, although an elliptical brick structure, most likely a well dating by artifact content to the period 1790-1810, was discovered.

Excerpts from the reports on these subsequent investigations by Ehrenhard, Prokopetz and Walker are presented as follows:

Archeological Excavations at Fort Moultrie
Ehrenhard: October 1975

On October 8, 1975 SEAC received a call from Sam May, Historic Reconstruction Supervisor at Fort Moultrie, saying that he had uncovered previously unrecorded brick and lime mortar foundations in the area of Moultrie III barracks. He suspected that this brickwork might be portions of Moultrie II barracks. After consultations between Pete Faust, Mr. May, and myself, it was determined that I should go to Charleston and investigate these new constructions.

While at Moultrie, I was also to attempt to locate the lightning arrester attached to the old storage magazine and test along the outer west wall of Moultrie III where construction of a visitor sidewalk was to be placed. This work was completed between October 14th and 21st.

Lightning Arrester

Excavations were conducted in the area between the west side of the old storage magazine and the west regaining wall. The remains of this object were located alongside the middle buttress of the magazine about 1 foot below Civil War grade. Three rotted posts of undetermined height (4" x 4") were discovered around a corroded metal shaft that appeared to have been attached to the side of the buttress. A larger post stain (4" x 7") was located at the juncture of the magazine wall and the buttress. (See Figure 18.) Further excavation revealed that the three remaining posts were spiked to wood sleepers which underlay the footings of the magazine. It is suggested that the larger post stain represents the pole that was used to support the metal cable lightning arrester, the base of which was attached to the buttress. The three smaller posts most likely provided support for the main pole.

Eliason Palisade of 1833

In 1833 South Carolina threatened secession in retaliation to Federal coercion and Robert Y. Hayne, Governor of South Carolina, called for 10,000 state troops to repel a possible Federal invasion. It was during this time that Cpt. Eliason was sent to Fort Moultrie to see to the defenses (Bearss 1968b: 72). The excavations (see map) undertaken along the route of the visitor walkway revealed the palisade built by Eliason in 1833 to protect the fort from a possible assault on Federal troops by South Carolina regulars.

The palisade was a cantilever construction located 10 feet from the base of the fort (Figure 19). Beams, 4" x 8", were laid out parallel to the fort; notched 1' x 9" beams of undetermined height were set along this runner and buried approximately 3 1/2 feet deep (Figure 20).

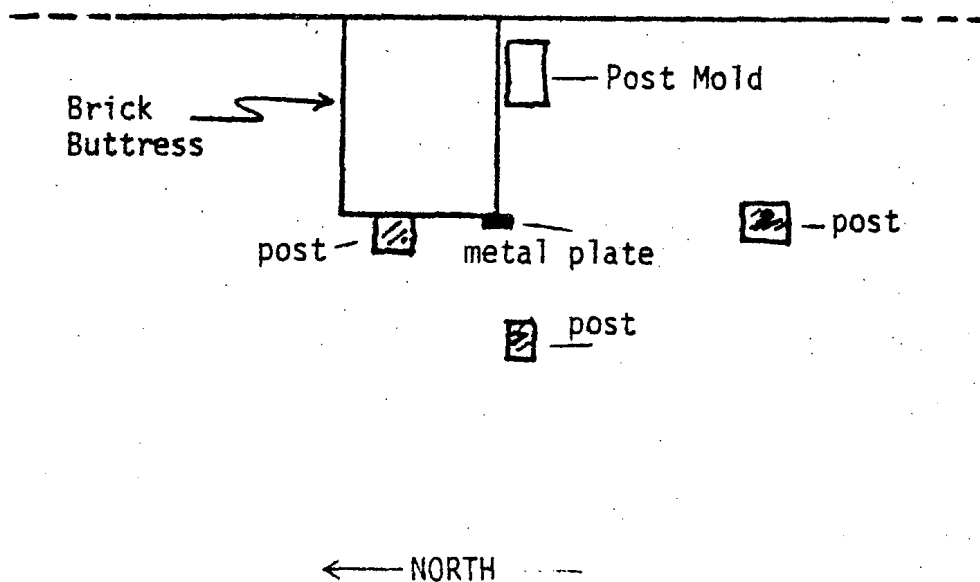
An interesting construction was located 2 feet west of the palisade in line with the postern gate. Construction details differ from Eliason's work. The structure when exposed was suggestive of a cavalier and it was first thought to be a portion of the west wall of Moultrie I. This work (Figure 21) was made of 13" x 8" timber partially spiked together with duck bill spikes (circa 1780). Two runners were pegged to the top of the timbers and formed a groove into which 6 1/4" x 6 1/4" timbers of undetermined height were set (Figure 22). Continued excavation in this area failed to uncover additional data as to the function of this work. No artifacts (other than the two spikes) were recovered which preceded the Civil War. While there is the possibility that this construction might represent some portion of Moultrie I it is most likely

a protective wall possibly filled with sand which was to protect the postern gate at the time of the Civil War.

Moultrie #2

Testing was undertaken in the vicinity of the barracks of Moultrie III. Excavations revealed a brick foundation approximately 8 inches lower than that of the former barracks. A lime and brick cap had been poured over this area to bring it up to grade with the parade ground; this was the primary reason that it has gone unnoticed.

These foundations were followed north to the parade wall; at this point they were removed to allow for construction of the parade wall. Excavations to the west revealed that the foundation continued underneath the brick traverse where continued excavation was impossible. No artifactual material was recovered which would help to date the time of construction; the brick and mortar are of the same type found in the later FOMO #3 barracks and parade wall. The one difference to date is that these newly discovered foundations do not have wooden beam plank footings as the other constructions do. No specific information could be located which would support or disprove the idea that these foundations are of FOMO #2. The fact that they are lower would suggest that they are indeed earlier (evidence of this is shown in the fact that the parade wall cut through them) and it would seem safe to say that there is a good possibility that these foundations are related to FOMO #2.

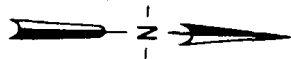


Scale--1:20

FIGURE 18. West Wall of Storage Magazine

Dashed line represents
portion of palisade excavated

ELIASON PALISADE
Sept. 3, 1833
National Archives RG 77
Files Drawer 65 Sheet 9



FORT MOULTRIE. III

FIGURE 19

FIGURE 20

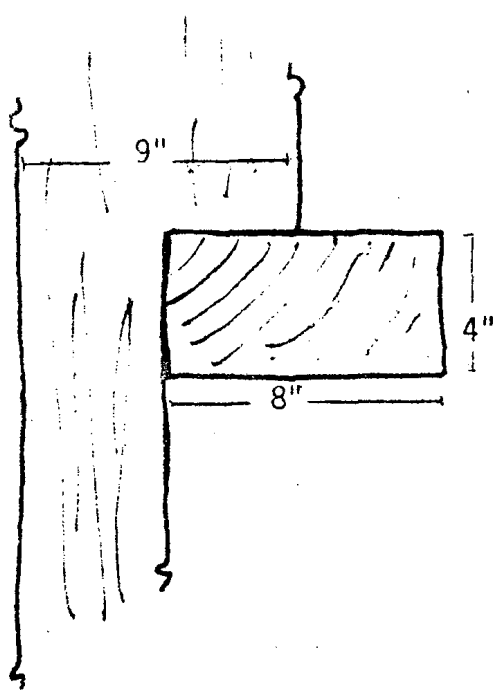


FIGURE 21

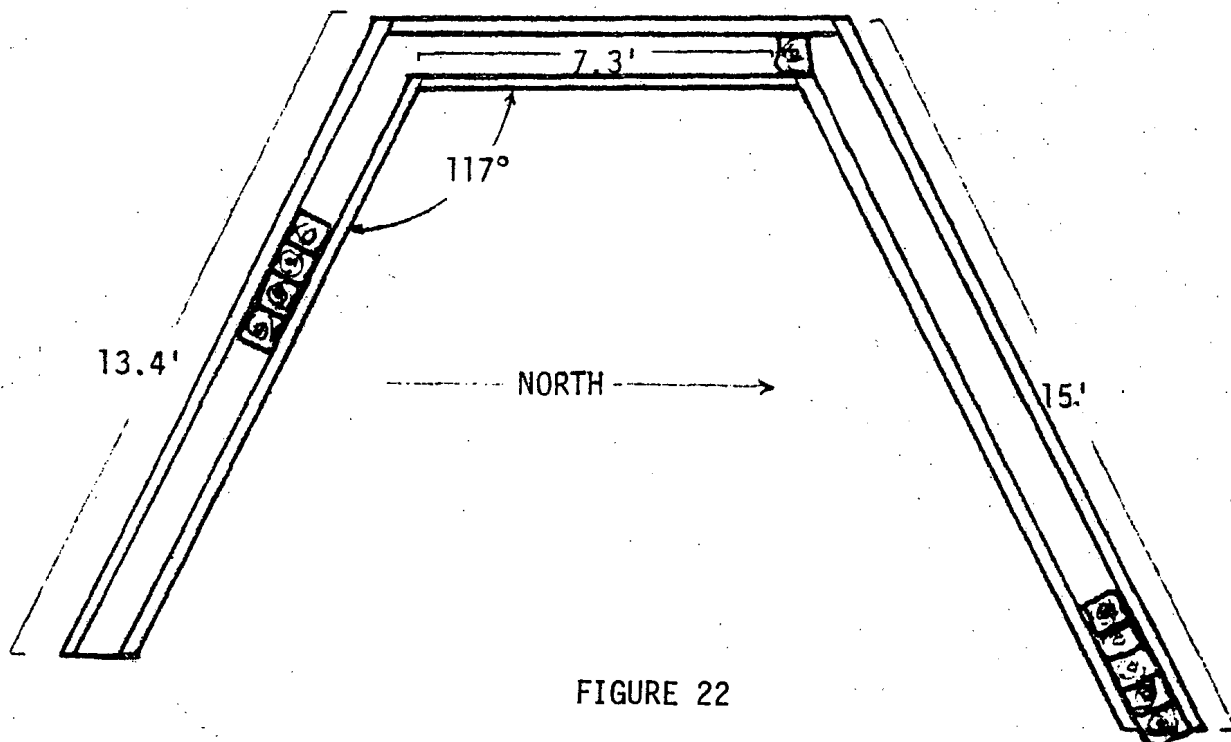
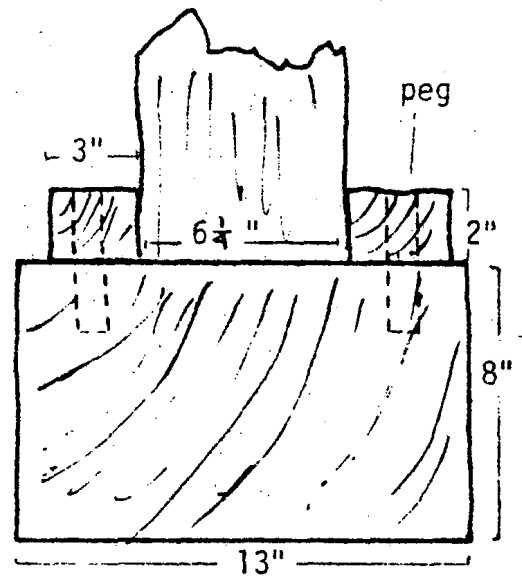


FIGURE 22

Monitoring of Electrical Company Excavations
at Fort Sumter National Monument
Prokopetz: January 1976

During the period of January 26 through 28, 1976, I monitored the trench being dug by the South Carolina Power and Light Company for the purpose of putting underground electrical lines at Fort Sumter National Monument. This trench is located on the north edge of Middle Street and passes completely across Park Service property. Sixty feet of open trench were examined during the time spent on the site. Observations indicate that the trench is not encountering any significant archeological features. This trench extends 3 feet below the surface; however, due to the presence of 15" to 18" of roadbed and asphalt in this area, the trench is only extending 18" to 24" into the original ground surface which was present prior to the construction of the road.

Maps from the excavations completed by the Institute of Archeology, University of South Carolina, hypothesized that the northwest bastion of Moultrie I might have been located in this area. The present trench has gone through this area and at the level excavated does not reveal the hypothesized bastion. A review of historical and archeological data indicated that the northwest bastion of Moultrie I was the only predictable archeological feature which could be encountered.

Archeological Feature Uncovered by Construction
in Middle Street Fort Moultrie
Walker: February 1976

As a representative of the South Carolina State Historic Preservation Officer, Dr. Robert L. Stephenson, Director of the Institute of Archeology and Anthropology of the University of South Carolina, accompanied by Institute archeologists Stanley South and Leland Ferguson, met with Brien Varnado, Acting Superintendent of Fort Sumter National Monument and John Walker, Southeast Archeological Center staff member on February 17th to discuss what should be done in regard to a brick-lined archeological feature (apparently a well) discovered during installation of underground utility lines.

Description of the Feature

The excavation showed the feature to be an elliptically-shaped, brick-lined structure, the opening of which measured 4 feet in width and 5 feet 2 inches in length. The higher (western) section of remaining brick wall measured 41 1/4 inches high; the lower (eastern) section measured 26 inches high. Supporting the brick wall was a 3-inch-thick wooden foundation, two planks in thickness. There was no floor as such; however, changes in soil coloration (medium gray to dark gray-brown), texture (sand to humus-like), and artifact content (sterile to artifact-bearing) made the base quite evident.

Description of Recovered Artifacts

The artifact content was surprisingly sparse. There was a readily observable intrusive pit in the south side of the feature; but the

gray sand fill was completely sterile except for the basal 2 inches. This contained the base and staves of a wooden barrel (this had been thrown into the well upside down), one brass button, one kaolin pipe stem fragment, sixteen fragments of bottle glass, sixteen fragments of hand-wrought nails, and nine ceramic sherds.

Estimated Date of Feature

On the basis of the artifacts the feature can be dated roughly at ca. 1790-1810. Two sherds of transfer-printed pearlware, dating ca. 1795-1840, were recovered from immediately beneath the wooden foundations. Other datable ceramics recovered from the base of the feature-- "annular wares" pearlware, ca. 1790-1820 and plain white delftware, ca. 1640-1800--would fit this date. The button which is of a type that Noel Hume dates ca. 1800-1830 also seems to corroborate this dating.

As yet it has not been possible to locate historical documentation for the feature.

In summary, archeology either directly or in taking advantage of opportunities to investigate prior to various developments has failed to provide convincing data on the location of the first fort. If a hypothetical location based on data provided by Ehrenhard and Hsu is not acceptable as "conjectural" then it must be assumed that the location of Moultrie I remains undiscovered.

NOTES

¹ In 1827 a hospital was proposed to serve the soldiers in the Charleston Harbor area. The choice of locations was between Fort Johnson on the south side of the harbor and Fort Moultrie on the north. Finally in 1828 the decision was made to construct a warehouse and hospital on the grounds north of Fort Moultrie.

The warehouse, built on the southeast corner of the tract, was not in the area of excavation. The two-story frame hospital was built fronting the sally port of the fort. Because of the generally wet ground condition, the building was elevated approximately 4 feet off the ground. Fourteen brick pillars, 2 feet 4 inches by 1 foot 6 inches and 4 feet high, supported the 50-foot by 26-foot structure (Myer, contract specifications N.D. N.A., R.G. 92). There were two stacks of chimneys for the four fireplaces.

Water for the hospital was contained in a brick cistern near the west end of the hospital. The 10-foot by 18-foot cistern was 8 feet high, 5 feet of which were above ground (Myer, contract specifications, N.D. N.A., R.G. 92).

Sixteen years later (1844) the hospital and six adjacent structures were moved from the middle of the parade ground to the periphery.

The army specifications allowed the contractor to reuse the bricks of the chimney and piers for the same purpose on the new location of the buildings.

²All five of the cannon tubes were forged for the United States Military during the latter half of the Civil War. The tube number, weight, foundry, inspector and year of casting were stamped on the muzzle and/or on one of the trunnions.

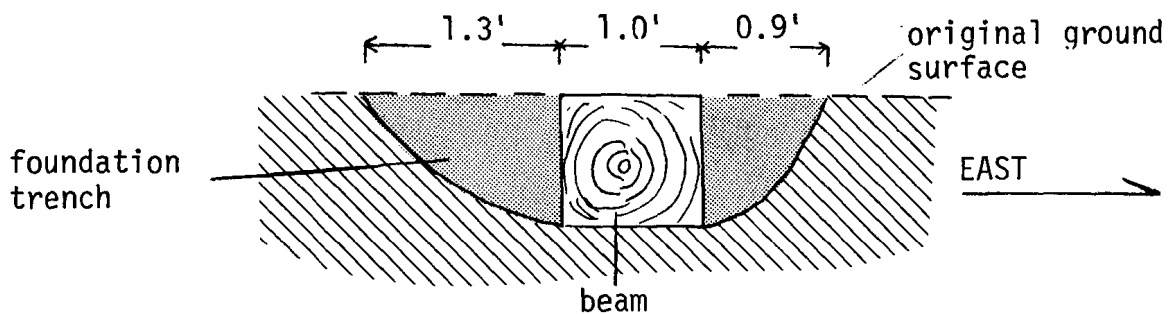
The two 8-inch Parrotts were casted by the West Point Foundry, Cold Springs, New York. Robert Parker Parrott was the operator and inventor of the Parrott rifled cannon (Ripley 1970:109). Both tubes, casted in 1864, were numbered consecutively 55 and 56. Richard M. Hill was the army inspector approving them. They weighed 16,412 pounds and 16,487 pounds respectively.

The Fort Pitt Foundry of Pittsburgh, Pennsylvania, holder of the Rodman patent, casted the two 10-inch Rodman tubes. Casted in 1863, they were numbered 156 and 182. Robert Henry Kirkwood Whitely inspected the tubes that weighed 14,956 and 14,980 pounds respectively.

The 15-inch Rodman was casted by the Scott Foundry of Reading, Pennsylvania. Scott Foundry had an agreement with the Fort Pitt Foundry to use the Rodman patent to cast the larger caliber guns (Ripley 1970:360). This 49,890-pound tube, number 21, could not have been casted before 1864 as William Prince was appointed an inspector in that year (Ripley 1970:357).

- 3 Excavations in the vicinity of the beams in Unit 3 revealed light stains in some areas. These appeared to be running parallel to the wooden construction. The stains were a light brownish gray (2.5Y 6/2) while the surrounding sand matrix was a slightly lighter shade of gray (2.5Y 7/2). While there is some speculation as to the true nature of the stains it is probable that they represent foundation or builders trenches. (See Figure 23.)

East Beam



West Beam

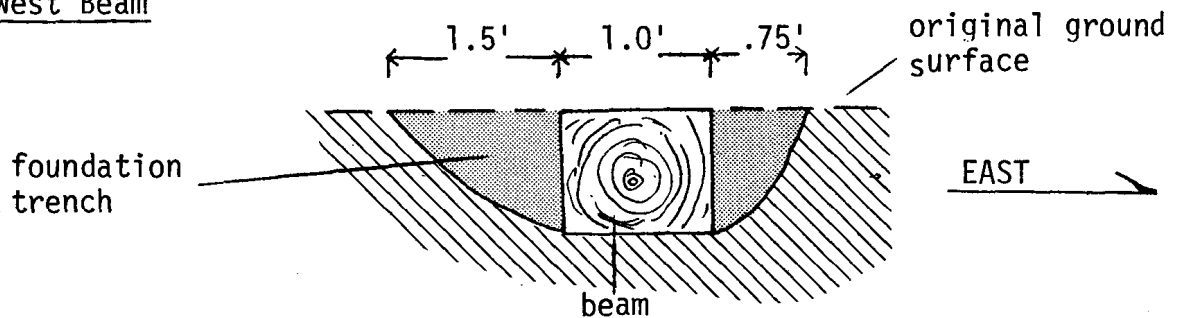


FIGURE 23

References:

Ripley, Warren
1970 Artillery and Ammunition of the Civil War. Promontory
Press, New York, N.Y.

APPENDICES

Five appendices have been included in this manuscript. We feel this information, some of which was gathered concurrently with the primary research, provides edifying supplementary data. Appendix A deals with the unexpected discovery of a cemetery while undertaking exploratory archeology in the vicinity of the proposed visitor center parking lot. A discussion of hydrological problems and findings is presented in Appendix B. Comments on the coding scheme used in our data analysis, the examination of unmodified vertebrate remains, and the soil resistivity study of the Fort Moultrie II area are provided in Appendices C through E respectively.

APPENDIX A

Cemetery

North of the fort, approximately 250 yards, was a cemetery of an unknown age. It was probably a civilian cemetery begun shortly after 1800. The island was a popular summer residence for the wealthy of Charleston and the surrounding plantation area. Although the area of the cemetery was originally part of the military reservation of Fort Moultrie I and II, the State of South Carolina did not acknowledge it as being part of the reservation for Fort Moultrie III. The United States Army believed that the tract was included in the land transfer of August 14, 1807 which allowed for the construction of Fort Moultrie III (Letter, Capt. A. H. Bowman, 12/23/1843).

In 1843 Gen. Armistead, the post commander, complained about the parade ground being inadequate for drill and review of the troops because of small size and that the post hospital and bakehouse were located in the center of the parade. To enlarge the parade the two structures were to be moved to the west side of the existing parade and the tract to the north was to be improved so it could be used also (Bearss 1968: 108). When the Army's plans became known Mr. G. B. Dyer laid claim to part of that tract which contained the graves of his relatives. There was a Sgt. Dyer stationed at the fort in 1808 and the Army maintained that the post commander had given the sergeant permission to build a structure on the tract (Figure 24) because of the lack of housing for married soldiers (Letter, Capt. A. H. Bowman, 11/6/1843).

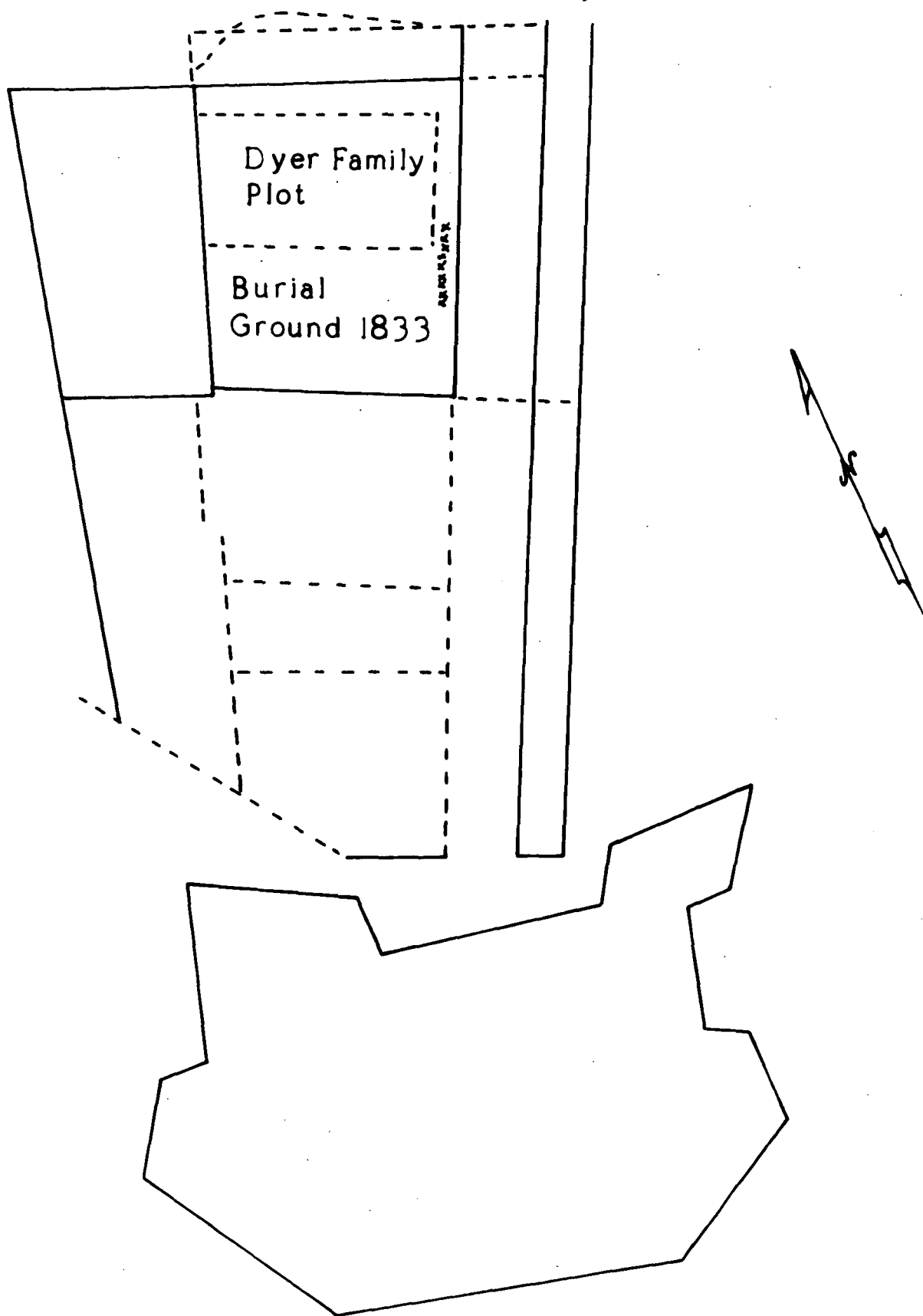


FIGURE 24. Location of Dyer Cemetery Plot

The following documents pertain to actions involving the Dyer plot:

COPY OF DEED, CHARLESTON COUNTY, S.C., MISCELLANEOUS RECORDS
BOOK 0-11, PAGE 204.

January 9, 1844

G. B. DYER TO UNITED STATES, DEED FOR LOT
THE STATE OF SOUTH CAROLINA. Know all men by these presents that I, George B. Dyer of the village of Greenville in the state aforesaid for and in consideration of the sum of one hundred dollars to me in hand paid by the United States by A. H. Bowman, Captain of Engineers, the receipt whereof is hereby acknowledged and in consideration that the United States will cause to be removed all the remains of the Dyer family interred in the place hereby conveyed from Sullivan's Island to the graveyard at Fort Johnson and there have them reinterred and designated by their proper names have bargained, sold, released and conveyed and by these presents do bargain, sell, release and convey unto the United States all the right, title, interest and estate to the lot of land situate, lying and being on Sullivan's Island in the state aforesaid and is the same represented on the plat hereto annexed with my name in my own handwriting endorsed thereon marked "Dyer"--together with all and singular the rights, members, hereditaments and appurtenances for the said property belonging or in any wise incident or appertaining, to have and to hold all and singular the premises above mentioned against every other person or persons whomsoever claiming by, under, or through me, and I do hereby bind myself, my heirs and assigns to warrant and forever defend the premises aforesaid unto the United States against me and my heirs and all persons claiming under or through me only. In witness whereof I have set my hand and affixed my seal at Greenville Court House the ninth day of January A.D. 1844 and in the sixty-eighth year of the independence of the United States of America.

WITNESSED BY:

O. B. IRVINE, Deputy Master,
Jefferson Choice, notary public
and magistrate

ADDENDUM BOOK 0, Page 205.

William Choice attests to dower relinquishment by
Mrs. Ann L. Dyer. Dated January 9, 1844.

ALSO: Page 205.

Robert Lebby, magistrate of St. Andrew's Parish (Charleston County, S.C.) attests that Charles L. Ingraham was witness to Dyer's signature along with I. D. Kartz of the "subjoined instrument." Dated April 11, 1844.

The "subjoined instrument" acknowledges that the United States has moved Dyer family remains as agreed to. This is dated April 11, 1844 and recorded April 22, 1844. Signed by Dyer.

Capt. Bowman of the Corps of Engineers on December 22, 1843 had secured from C. B. Dyer a proposition for the sale of "his alledged interest in part of the land attached to Fort Moultrie." In doing so Dyer proposed to reserve a small plot from 15 to 20 feet square "containing the graves of his relatives, and to sell all his right title and interest to the balance for \$100", the graves to be enclosed with a neat paling fence by the United States. Although Bowman questioned Dyer's title to anything but a house on the desired tract, he did not believe the South Carolina assembly would "make the desired recession until the claim was extinguished." As the reservation was cramped, Bowman recommended that the War Department meet Dyer's demands (Bowman to Totten, December 23, 1843, NA, RG 77).

On January 9, 1844 an agreement was reached between Dyer and the United States. Bowman, on behalf of the War Department, agreed to pay Dyer \$100 for the lot in question and to see that the United States moved the bodies (Gates to Jesup, May 21, 1844, NA, RG 92).

A yellow fever epidemic in the autumn of 1858 claimed the lives of about one-half of the garrison--40 men. As to be expected under such circumstances, the survivors were "obliged to bury" the dead immediately,

"as each case occurred, roughly boxing them up, and then putting them down two feet deep in the ground and water...and except in one or two instances without the customary religious observances." The redlegs had acquiesced in these crude proceedings as unavoidable, but they were heard to mutter, "They buried us like dogs."

As soon as the crisis passed, the post commander, Lt. Col. John L. Gardner, contacted Gen. Jesup for an allotment of \$250 to fence the post cemetery and to put up headboards for the deceased. On doing so he pointed out that as Moultrieville was the resort of the "first people of Charleston" to leave...

...our dead buried here in the present condition, would be deemed by them very scandalous—the cattle tramping over the graves and actually as occurred yesterday breaking through their very coffins, not above a foot beneath the surface.

Upon receipt of word that his request had been approved, Col. Gardner turned out a detail fencing the post cemetery. In 1868 the bodies were disinterred and transferred to the U. S. National Cemetery at Beaufort, South Carolina (Gardner to Jesup, November 29, 1858, NA, RG 92).

* * * * *

Initial excavations revealed a staggered row of burials, approximately 2 feet below the present-day surface and 6 inches below the current level of the water table. The area was necessarily dewatered. All caskets appeared to be constructed of cypress lumber fastened by wrought iron nails with lead heads; each had suffered post interment structural damage. Descriptive data concerning the interments is presented in Table 1. In many cases this may be attributed to construction activities relating to modern water and sewer lines (Figure 25) as well as the landfill practices employed after the demolition of the 1930 hospital (Figure 26).

Natural forces and exposure caused rapid deterioration of several caskets and required preventative maintenance. This necessitated the removal of lid portions from three individual interments. It is interesting to note that the skeletal remains were in complete anatomical disarray. It is suggested that this results from fluctuations in the water table and fiddler crabs

The only nonskeletal artifactual material observed were remnants of two shoe soles recovered from a rectangular casket similar to No. 10 (Figure 27&28). This burial was badly disturbed by later landfill in the area of the "burial ground" shown on the plat of Sullivan's Island, October 30, 1833 (Drawer 65, Sheet 11, National Archives).

There was no distinction between left and right foot. From their position in the casket the most complete sole was from the left foot. The insole measured 8.9 inches long, 2.9 inches wide across the sole

TABLE 1 Descriptive Data from Cemetery Area

Casket No.	Length (")	Width at Head	Width at Foot	Greatest Width Observed	Depth	Orientation*	S. D.**	Comment
1	79 1/2	15 1/2	13 1/2	21	11	West	2.10	Completely exposed (male)
2	79 1/2	12 1/4	11	22	11 1/2	East	1.96	Completely exposed (female)
3	50 1/2	-	-	20	11	West	2.26	-
4	36	-	-	19	11	-	2.30	-
5***	8 3/4	-	7	-	11 1/2	West	2.08	Infant
6	43	-	-	15	11 1/2	West	1.96	-
7	-	-	-	-	-	West	2.96	Fragmented, destroyed by modern sewer line
8	19	7	-	10	11	-	2.28	Child
9	54	-	-	24 1/2	11	-	2.52	Rectangular casket
10	15	-	10	-	11	East	2.22	-
11	37	-	-	20 1/2	11	West	1.58	-
12	20	11	-	-	11	East	2.28	Fragmented
13	-	-	-	-	11 1/2	West	2.33	-
14	47	15	-	20	-	-	2.04	Fragmented
15	-	-	-	-	-	East	2.04	-
16	37	15	-	20	11	-	1.92	Lies between casket no. 12 and no. 13. Late discovery, 6" from no. 12.
17	-	-	-	21	11	-	-	Lies between casket no. 9 and no. 10. Late discovery, 20" north of no. 10.
18	30	-	-	22 1/2	11	-	-	-

1

2.16

* Orientation was based on location of skull
 **S. D. is the depth from the present-day surface
 *** See Figure 4



FIGURE 25. Water Main in Excavation 4 Overlying Casket No. 6

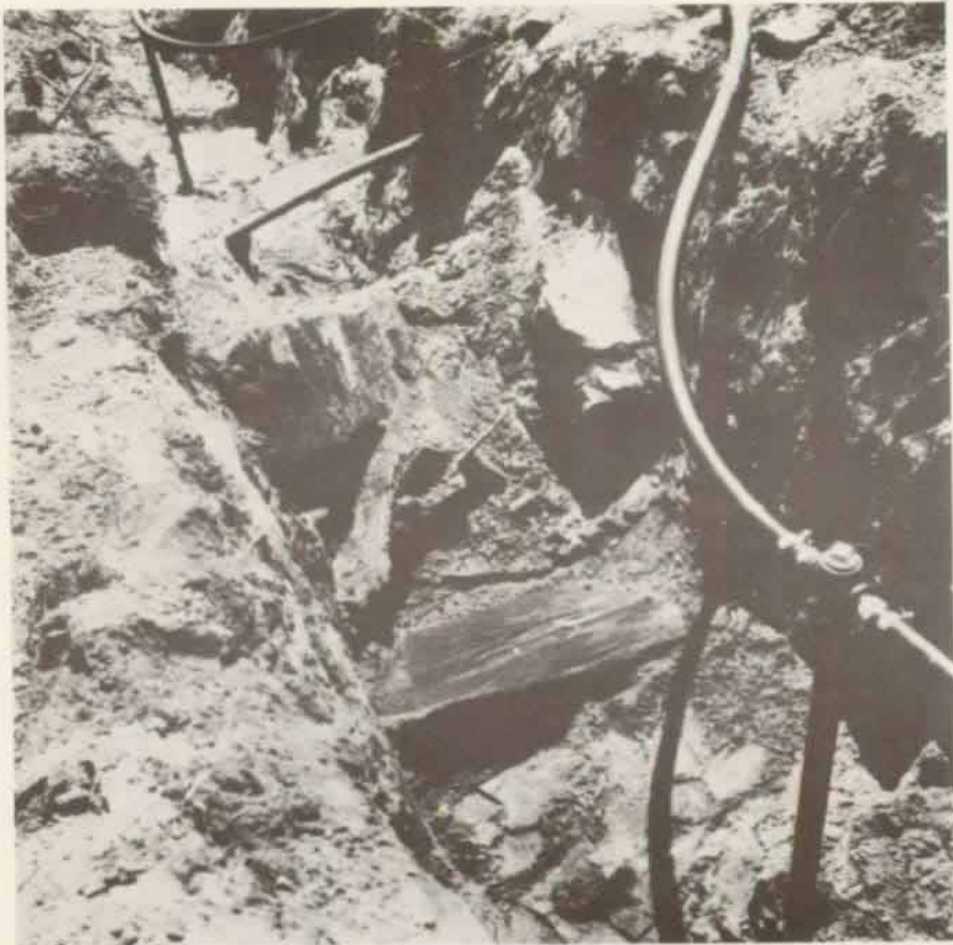


FIGURE 26. Modern Brick Rubble and Electrical Conduit
on Casket No. 15



FIGURE 27. Two Styles of Caskets: Unequilateral Hexagon - Casket No. 9
Rectangular - Casket No. 10



FIGURE 28. Excavation of Casket No. 5

and 2.3 inches wide across the heel. The thread holes are oval and irregularly spaced indicating machine stitching. The heels show three nail holes for attachment, but none are visible on the toes. A thread channel is visible on the insole rib, welt, and bottom of the outsole. The individual appeared to have a "duck foot" gait as the insides of the heels were more worn than the outsides.

Various inventions for the mass production of foot wear occurred in the 1830-1870's (Anderson 1968: 56-62). The sewing of the uppers to the sole was made possible by Lyman R. Blake's machine, patented in 1860 (Anderson 1968: 59); prior to that only the upper portions of the shoe could be stitched; the sole components and uppers were nailed or pegged together. In 1864 Gordon McKay (Anderson 1968: 59) patented his machine that could stitch the entire upper to the sole, eliminating the necessity to nail the toe and heel.

There is no indication of how quickly these inventions were adopted by the shoe manufacturing industry; with severe competition, they were probably adopted very quickly. Based on these patents' dates, these shoes were manufactured between 1860-1865.

This burial is much later than 1843 when the United States Government obtained possession of the "burial ground" and made it part of the parade ground north of Fort Moultrie. The deceased may have been a victim of the Yellow Fever epidemic of 1858 which claimed the lives of approximately 40 soldiers: "As each case occurred, roughly boxing them up, and then putting them down two feet in the ground and water...

and except in one or two instances without customary religious observances" (Bearss 1968:123). Although all the victims were supposed to have been buried at the post cemetery, one or two may have been interred in the side of the parade ground adjacent to the hospital. This area was formerly the general vicinity of the "burial ground."

References:

Anderson, Adrienne

1968 The Archaeology of Mass-Produced Footwear. Historical Archaeology, Vol. II. Lansing, Michigan.

Bearss, Edwin C.

1968 Fort Moultrie, No. 3. Fort Sumter National Monument Historic Structures Report Historical Data Section, Division of History, Office of Archeology and Historic Preservation, U.S. Department of the Interior, National Park Service.

Bowman, Capt. A. H.

1843 Letters of Capt. Bowman are on file at the reference library at Fort Sumter National Monument.

APPENDIX B

Hydrological Problems and Findings

Fort Moultrie, resting about 10 feet above sea level, is located in the southern sector of a barrier island. A wide berm faces the Atlantic to the south and a tidal marsh at the estuarine environment is located to the north. At least one freshwater lens aquifer is present in the area as is an artesian well (EIS 1974: 45). Soils are predominately of wind and water deposited beach sands covered with Bermuda and Charleston grasses. Groundwater levels in the fort vicinity vary with the seasons and tides but appear to average 4 feet below the present-day surface.

Fort Moultrie is situated on an island just outside the north bank of the Charleston Harbor. Its low profile, never rising higher than 10 feet above sea level, provided the archeologists with a serious hydrological problem as groundwater, which fluctuated with the tides, was reached in the excavations anywhere from 2 to 4 feet below the present-day surface.

The never ending infiltration of water into the excavations, malfunctioning pumps, and clogged well points and lines became such a headache that the subject of groundwater, the nature of soil bodies, and the mechanics of dewatering became a topic of interest. It is hoped that the general comments made here with respect to these subjects, based on our admittedly limited experience and belated revelations, may help others who may deal with problems of dewatering in the future.

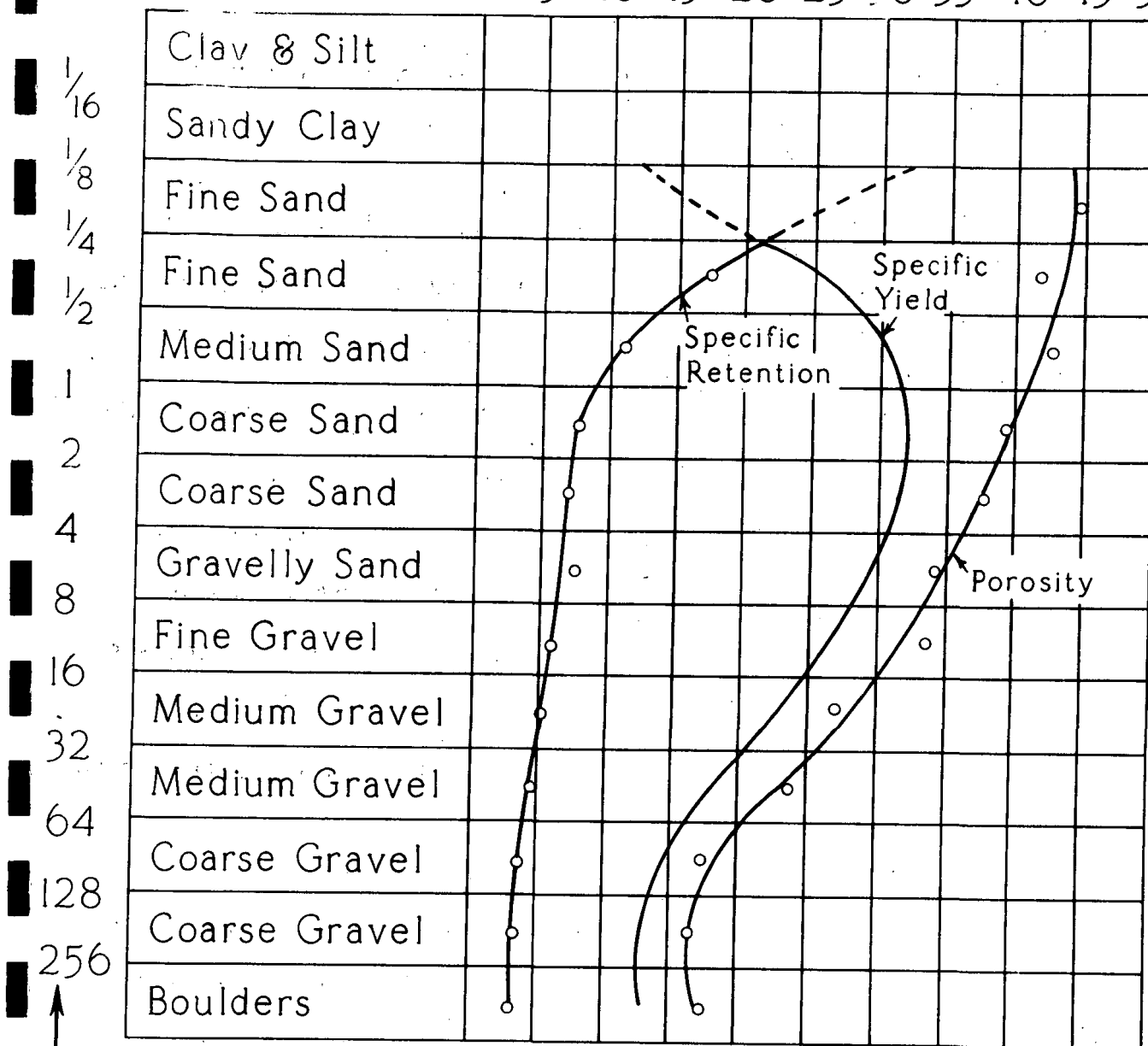
Nature of Soil Body

For simplicity, it will be assumed that all soils can be divided into two classes which will be referred to respectively as sand and clay. In general, sands are composed of macroscopic particles that are "rounded" or angular in shape. They drain readily, do not swell, possess insignificant capillary potential, and when dry exhibit no shrinkage. Clays, on the other hand, are composed of microscopic particles of platelike shape. They are highly impervious, exhibit considerable swelling, possess a high capillary potential and demonstrate considerable volume reduction upon drying.

In problems dealing with groundwater the "soil body" is considered to be a continuous medium of many interconnected openings which serve as the fluid carrier. That portion of a soil not occupied by solid matter may be occupied by groundwater. These spaces are known as voids. The nature of the pore system within the soil can best be visualized by inference from the impermeable boundaries composing the pore skeleton. They are fundamentally important as they act as groundwater conducts. Typically, they are characterized by their size, shape, irregularities and distribution.

Let us assume for the purposes of this discussion that the soil particles are all of uniform spherical shape. The porosity of a soil is a measure of the contained voids and may be expressed as the percentage of void space to the total volume of the mass (Figure 29). Calling the total volume (V) and the "volume of voids"

Percent
0 5 10 15 20 25 30 35 40 45 50



Maximum 10 % grain size, millimeters
(the grain size in which the
cumulative total, beginning
with the coarsest material,
reaches 10% of the total
sample)

POROSITY, SPECIFIC YIELD, & SPECIFIC RETENTION VARIATIONS WITH GRAIN SIZE

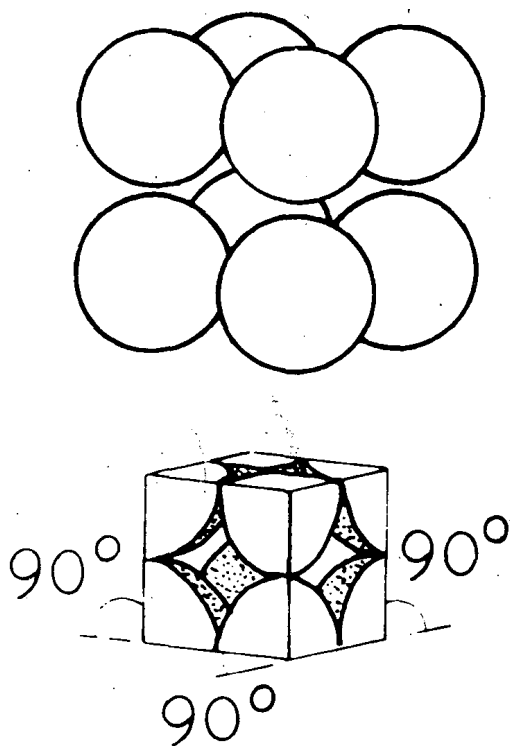
FIGURE 29. Porosity, Specific Yield, and Specific Retention
Variations with Grain Size

(V_1), we have for the porosity: $P = \frac{V_1}{V}$, and for the void ratio:
 $V_r = \frac{V_1}{V - V_1}$.

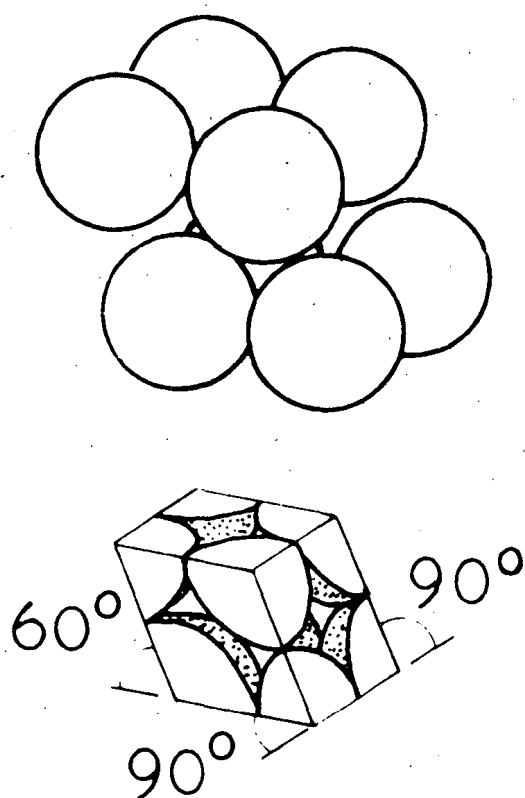
For a cubical array of uniform spheres, porosity can be expressed as: $P = 1 - \frac{\pi}{6} = 0.476$. For a rhombohedral packing, which represents the most compact assemblage of uniform spheres, the porosity is: $P = \frac{1 - \sqrt{2}}{6}\pi = 0.26$. Figure 30 shows the pore volume available for the flow through the cubic and rhombohedral arrays respectively. It should be noted that even in the ideal porous medium the pore space is not regular but consists of cavernous cells interconnected by narrower channels. Natural soils contain particles that can deviate considerably from the spherical shape and are far from uniform in size. The true nature of the pore channels defies rational description.

The subsurface occurrence of groundwater may be divided into zones of saturation and aeration. In the zone of saturation all voids are filled with water under hydrostatic pressure. The zone of aeration consists of voids occupied partially by water and partially by air. Water occurring in the zone of saturation is commonly referred to simply as groundwater. This general zone may be further subdivided into: (1) the soil water zone, (2) the intermediate zone, and (3) the capillary zone; thickness of zones varies with soil types and vegetation (Figure 31).

Soil Water Zone: Water in the soil water zone exists at less than saturation, except temporarily when excessive water reaches the ground surface as from rainfall or irrigation.



Spherical
Packing



Rhombohedral
Packing

FIGURE 30. Pore Volumes

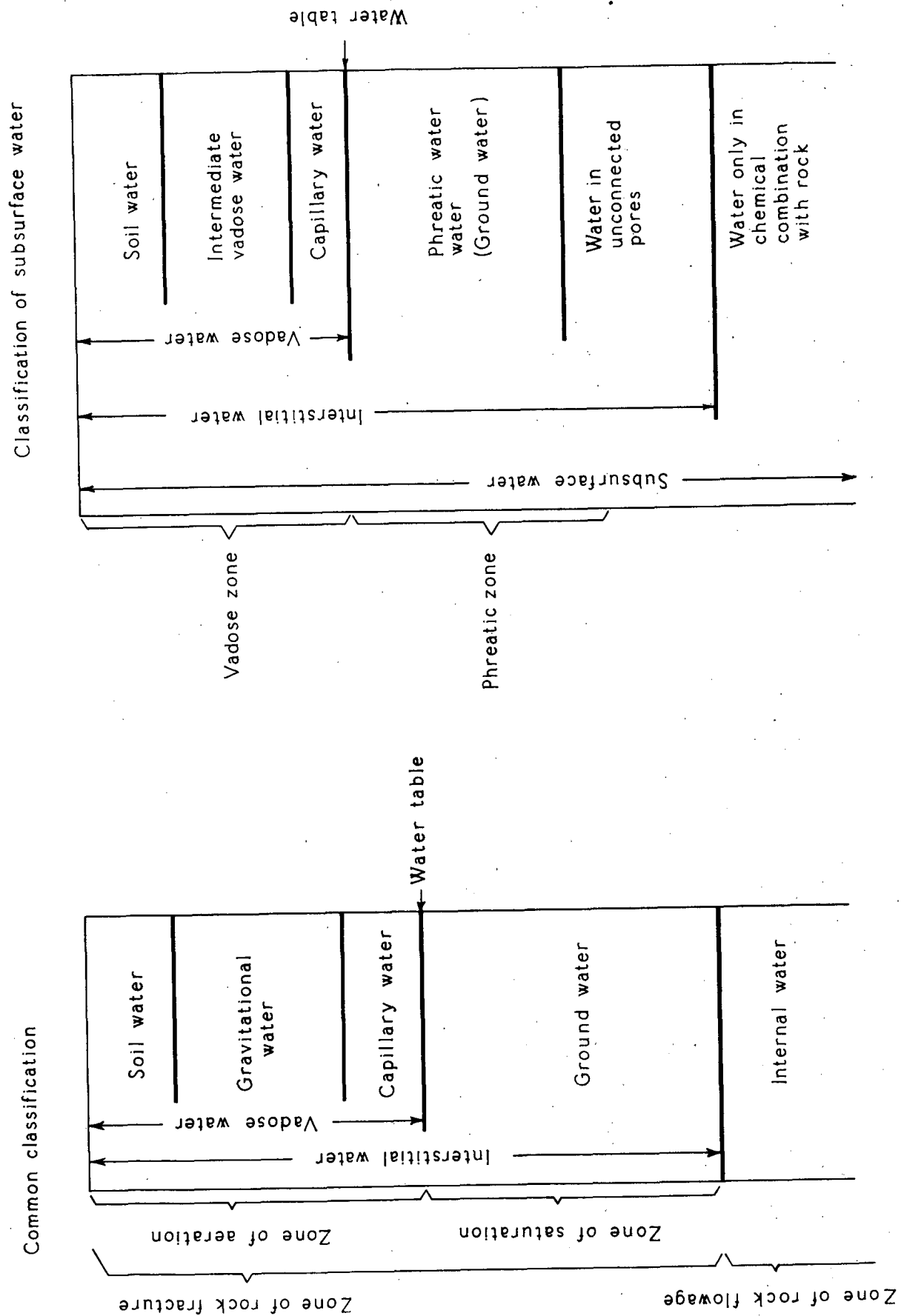


FIGURE 31. Subsurface Occurrence of Groundwater

Intermediate Zone: The intermediate zone extends from the lower edge of the soil water zone to the upper limits of the capillary zone. It may vary in thickness from zero, when the bounding zones merge with a high water table approaching the ground surface, to several hundred feet under deep water table conditions. The zone serves primarily as a region connecting the ground surface to that near the water table through which water moving vertically downward must pass.

Capillary Zone: The capillary zone extends from the water table up to the limit of capillary rise of water.

Saturated Zone: Groundwater fills all of the voids in the saturated zone.

Principals of Operation

The principle of operation in "well pointing", also known as a sand point or well point, is to drive a screened, perforated pipe or pipes into the ground ahead of excavation so that the water may be drawn from the subsoil by pumping. Usually water under pressure is used to jet a hole large enough for the point to enter the ground. Choking of the screen can be overcome by jetting a hole larger than the point so that the space around it can be filled with coarse sand or fine gravel which will form a screen additional to that provided by the well point.

When the points have been sunk "swing arms" are connected to the suction header and stop valves fitted between the header and swing arms allowing for the isolation of any well point (Figure 32). Connections from the well point must always rise to the header which should in turn rise to the pump. This will eliminate the possibility of vapor locks forming.

Well points at Fort Moultrie were either a "progressive" or "ring" layout. The progressive layout is used for excavating trenches, the ring system for excavating a set area. In the progressive layout the suction header is placed alongside the line of the proposed trench. Depending upon the strata and quantity of water to be handled, either a single row of well points or one on each side of the trench is required (Figure 33). If the trench is being excavated by hand the points may be located close to the trench sides, but if heavy equipment is used suction heads should be outside the tracks of the machine. Points can be spaced at standard intervals or multiples of standard intervals according to the nature of the ground and the quantity of water. In fine running sand wide spacing will usually suffice but in loose gravels or coarse sand where large volumes of water are encountered close spacing may be necessary.

Typical pumping equipment consists of a self-priming single stage centrifugal pump. This type of pump will lift a liquid provided the pipe between the supply and the pump housing enclosing the impeller

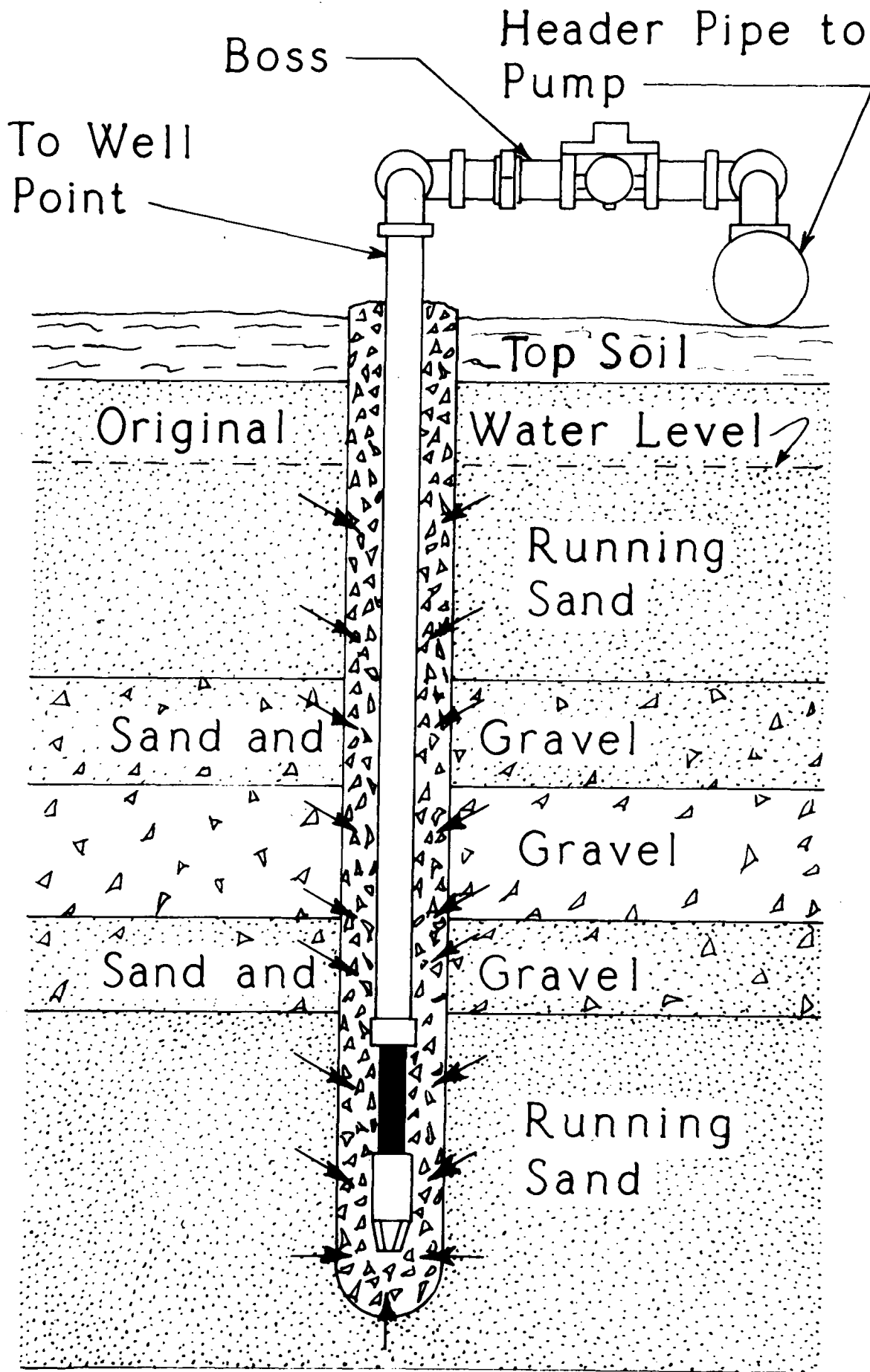
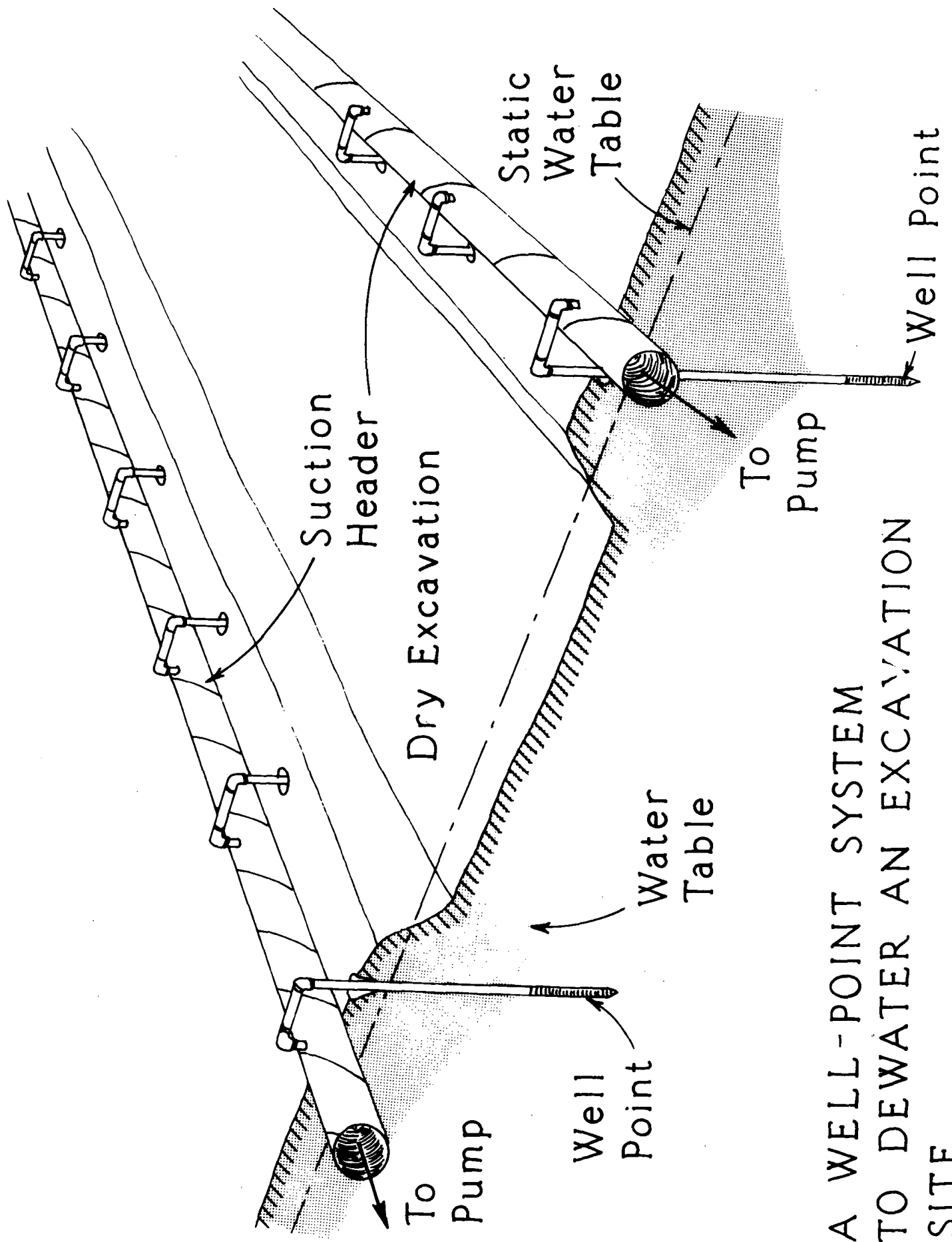


FIGURE 32.
Sand and Gravel



A WELL-POINT SYSTEM
TO DEWATER AN EXCAVATION
SITE

FIGURE 33. A well-Point System to Dewater an Excavation Site

is completely filled with water before the machine is started. Pumping will continue so long as no air accumulates around the impeller.

A certain amount of pressure is required to get water flow into a pump before additional pressure or velocity can be added. For our purposes this "head" is expressed as energy/pounds due to pressure and is known as the "Net Positive Suction Head" or NPSH.

A pump must be installed so that the head available at the intake is equal to or greater than the rated NPSH of the pump. If the available head is less than the required NPSH the pressure in the well point reduces to the vapor pressure of water and the pump will "cavitate". Cavitation is the formation of a vacuous space around the impeller which is normally occupied by water. This subsequently reduces the pumping capacity.

When a well point is pumped, water is removed from around the point and the water table is lowered. The drawdown at a given point is the distance the water level is lowered. A drawdown curve shows the variation of drawdown with the distance from the well (Figure 34).

In three dimensions the drawdown curve describes a conical slope known as the cone of depression. The outer limits of the cone define the area of influence of the well.

For a given well the drawdown can be determined at any point if the well discharges are known or vice versa. The drawdown at any point

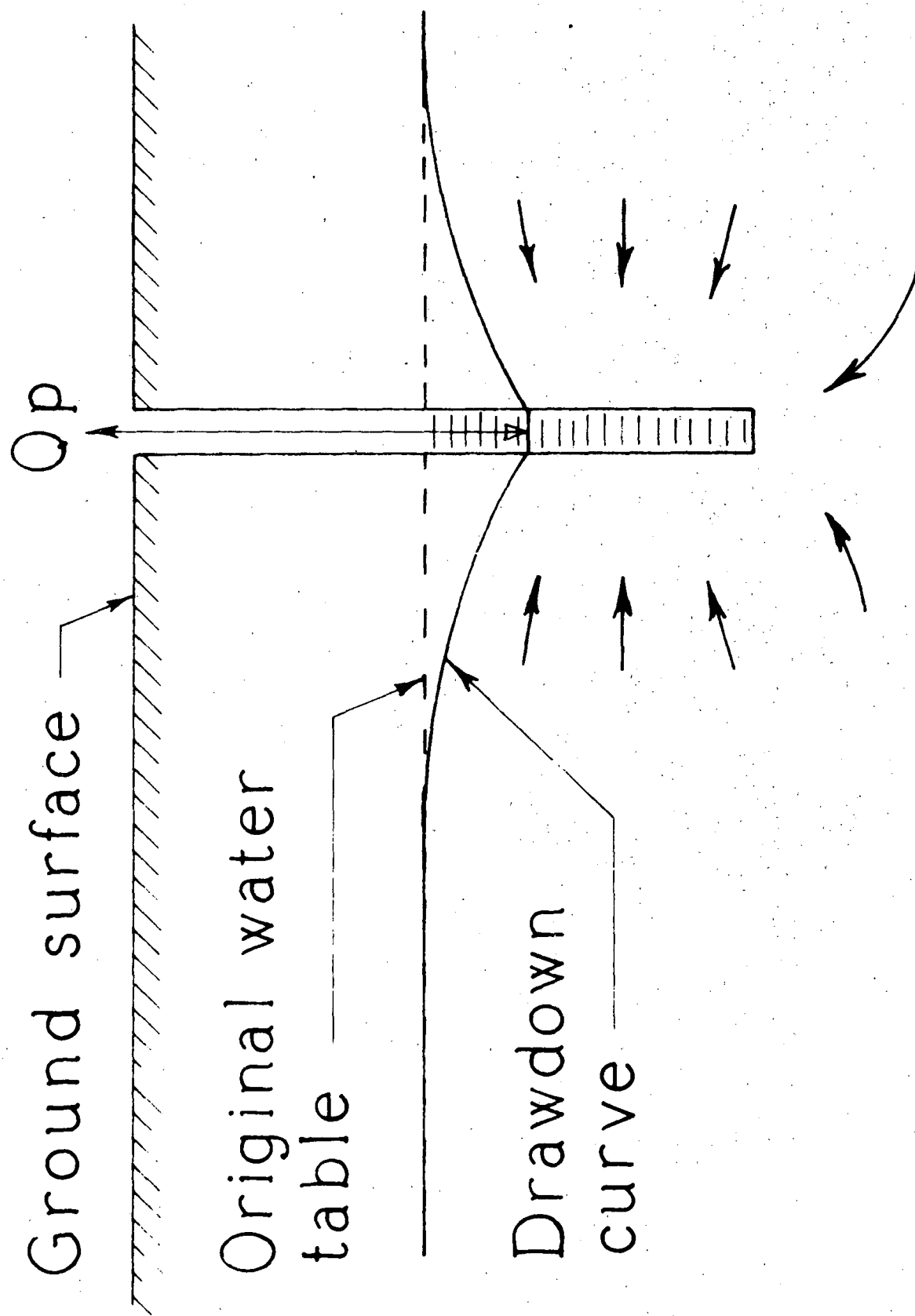


FIGURE 34. Drawdown Curve and Cone of Depression

in the area of influence is equal to the sum of the drawdowns caused by each well individually. Thus:

$$D_T = D_A + D_B + D_C + D_N$$

D_T is the total drawdown at a given point and D_A , D_B , D_C , D_N are the drawdown values at the points caused by the discharge of wells A, B, C, N respectively. The summation of discharge may be illustrated as shown (Figure 7); the individual and composite drawdown curves are given for Q_1 , Q_2 , Q_3 .

The purpose of well screens and gravel packs is to maintain open access within the water bearing stratum while ensuring that it operates freely once installed. A screen and many times a gravel pack are an absolute necessity if the well draws on fine unconsolidated sands. The screen and pack should prevent first the collapse of the well due to the abstraction of large quantities of sand, and secondly, damage to the pump due to sand particles in the water.

The use of correctly designed equipment is important to the overall efficiency of the dewatering system. Well screens' designs should incorporate the following features:

1. prevent movement of sand into the well
2. have effective nonclogging openings; slot size should match gravel pack medium or that of the surrounding area
3. have maximum open area of screen
4. have adequate strength to prevent its collapse
5. have a low inlet resistance
6. screen should be corrosion resistant

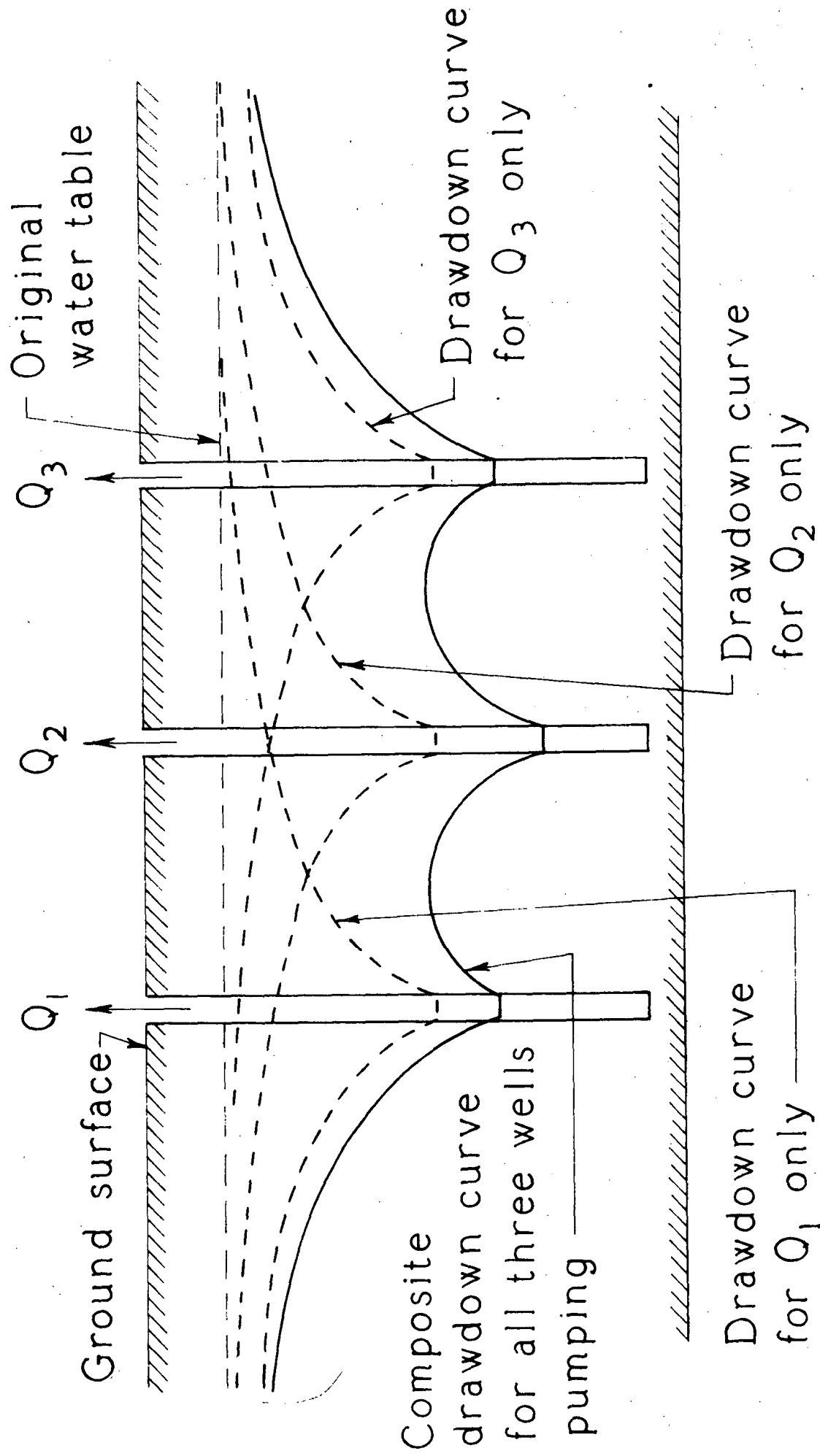


FIGURE 35.

Individual and composite drawdown curves for three wells in a line.

Gravel packs should include the following design features:

1. be sand free after development
2. give lowest possible resistance to permeation
3. offer low entrance velocities

The gravel pack should ensure that the completed well operates free of sand; thus, the particle size of the pack depends upon the particle size of its surroundings.

There are several basic requirements for a gravel pack: For formations of sand, the aquifer must be stabilized. It is not usually practical to have very small slot sizes and so an artificial gravel pack should be selected which forms the correct size of pore opening and stabilizes the sand in formation. The use of a pack in a sand formation enables the screen opening to be considerably larger than if the screen were placed in the formation by itself. The pack adjoining the screen consists of larger sized particles than the surrounding formation, and hence, larger voids are formed at and close to the screen allowing water entry nearly free from head loss.

The grain size of a gravel pack should be chosen so that it ensures that the completed well operates sand free. Standard sieve analyses should be used for all determinations of aquifer size for the design of gravel packs. The gravel pack standard grain size is equal to the aquifer standard grain size multiplied by the screening factor.

$$G. P. S. G. S. = A. S. G. S. \times \text{Screening Factor}$$

Charts for determining the standard grain size of any type of aquifer are commercially available.

The well screen should not retain all the surrounding aquifer of gravel pack contents but should be designed to allow the fine and medium size particles to wash out during the development of the well; however, screens still tend to become blocked and restrict the open screen area. Blockage of the openings will cause higher velocities of the water locally which will carry larger particles from the surrounding formation and lead to further blockage. A uniform distribution of inlet openings will, if spaced as close as possible, provide uniform development over the length of the screen and so avoid areas of underdevelopment and high velocities.

It is suggested that an open area greater than 25 percent gives little increase in efficiency; however, the performance decreases considerably when the open area is less than 15 percent. To a point, the higher the percentage of open area available the more area there is to be blocked before head loss becomes significant; and therefore, an additional open area should result in an increase in efficiency over a longer period of time.

The screen length and diameter can be chosen from the slot size and total opening required. Allowance should be made for 50 percent of the open area becoming blocked. The screen length is a function of the hydrogeology while diameter depends primarily on choice, the method used to drill the well, or a combination of both.

Determination of screen slot size depends on the critical particle size of the aquifer or gravel pack to be retained. A standard sieve

analysis of the aquifer or pack determines this size (commercially available).

Commercial well screens' slot design:

1. slotted rings
2. wedge-shaped bars or rings
3. bridge slots
4. louvre slots

In the design of simple slotted screens, it was found that circular perforations were not satisfactory, and oblong slots were developed. These have open areas as high as 40 percent; however, the slot was completely punched out, and there was considerable loss of strength. The slots may be vertical or horizontal, but it is suggested that vertical slots may not stabilize fine particles. Horizontal slots stabilize these particles, but they tend to "bridge over" the slot. These screens tend to have a high degree of blockage.

A temporary form of screen is the mesh type, in which a wire screen mesh is placed around a well-perforated tube. High corrosion and clogging are the disadvantages that occur with this type of screen.

Wedge-shaped bars or rings can be arranged to give a continuous opening in the form of an "inverted V", with the narrow opening on the aquifer side either in the vertical or horizontal plan. Horizontal slots are usually formed on a continuous wire-wound process. Advantages claimed are that a large open area is given, that slot width can be varied over a large range, and that the wedge-shaped bars or rings give strength. Clogging is said to be small; however,

the effective open cross-sectional area may be limited by the transverse or longitudinal bracing.

The bridge slot screen is an adaptation of the simple slot screen, only here the perforation is not completely pressed out but is allowed to form a bridge over the opening. This produces a higher strength than simple slot designs, and gives up to 30 percent open area. A limited series of slot sizes can be provided, and good gravel deflectors are formed.

If the hole is pushed out of the screen so that a small "roof" is left projecting over the hole, then the louvre perforation is formed.

Claims are made that:

1. added strength is given.
2. material is prevented by the roof from running down into the well.
3. as there are no parallel surfaces, the degree of clogging is small.

Screen Material

Well screens are readily supplied in a number of materials:

- commercial steel
- steel coated with chlorinated rubber
- galvanized steel
- plastic coated steel
- plastic
- copper
- stainless steel
- aluminum
- fiberglass

In conclusion, it must be remembered that each site necessitating dewatering will involve its own special problems involving soils, porosity, amount of water, etc. What works at one site may or may not work elsewhere.

An understanding of possible hydrological problems, with possible solutions thought out in advance of fieldwork, can in many instances save valuable time and expense.

References:

National Park Service

1974 Master Plan and Development Concept Plan, Fort Sumter
and Fort Moultrie National Monument. Southeast
Regional Office, United States Department of the Interior.

APPENDIX C

In the course of our analysis the data was transcribed on to IBM cards so that it might be made available to electronic data processing. The data was then utilized in statistical procedures which were aimed at examining the characteristics of variable distribution as well as interrelationships. One-way frequency distributions and accompanying statistics of each excavation unit and provenience were generated with the SPSS subprogram "CODEBOOK." Two procedures utilized for examining the relationships between variables were "CROSSTABS" AND "FASTABS." These compile tables of cross tabulations and produce nonparametric statistics from them.

These procedures were undertaken at the Florida State University Computing Center with the aid of a CDC-6000 computer utilizing SPSS, version 5.8. For a complete discussion of SPSS programs and sub-routines, consult Nie (1970). The primary data and the generated output are in permanent file at the Southeast Archeological Center, Tallahassee, Florida.

References:

- Nie, N. H., Dale H Bent and C. Hadlai Hull
1970 Statistical Package For The Social Sciences. McGraw-Hill Book Company, 330 West 42nd Street, New York, New York.

APPENDIX C

FINAL FORT MOULTRIE CODING KEY

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
1. Site	1	Fort Moultrie
2. Archeologist	1	Hsu
3. Classification	00	unknown
	01	ceramic
	02	glass
	03	metal
	04	bone
	05	wood
	06	shell
	07	stone
	08	plaster
	09	charcoal
	10	coal
	11	botanical
	12	brick
	13	plastic
	14	rubber
	15	leather
	16	ivory
4. Catalog Number	Alphanumeric	1142-5087 prefix C, A, B...
5. Locality	u0000	unknown/surface
	E1A	
	E1AB1	
	E1B1	
	E1B12	
	E1B2	
	E2A1	
	E2A2	
	E2B1	
	E3A1	
	E3A2	
	E3B1	
	E3B2	
	E3C1	
	E3C2	
	E3D1	
	E3E1	
	E3E2	
	E3F1	
	E3F2	

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
5. Locality (con.)	E4A1	
	E5A1	
	E5B	
	E5B2	
	E5B3	
	E5A12	
	E5A2	
	E5A3	
	E5A4	
	E5B4	
	E5C1	
	E5C12	
	E5C2	
	E5C3	
	E5D	
	E5D2	
	E5D3	
	E5D4	
	E5E1	
	E5E2	
	E5E3	
	E5F1	
	E5F12	
	E5G	
	E5H	
	E6A1	
	E6A12	
	E6A3	
	E6D12	
	E6D3	
	E7A1	
	E7D	
6. Object	00	unknown
	01	vials
	02	bottle
	03	stopper
	04	lip
	05	neck
	06	body (glass)
	07	base
	08	rim
	09	body (pottery)
	10	foot
	11	cup
	12	bowl
	13	plate
	14	saucer
	15	pipestem
	16	pipe bowl
	17	furniture

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
6. Object (con.)	18	marble (toy)
	19	slate
	20	push
	21	mixed
	22	appendage
	23	sample
	24	button
	25	bullet
	26	post
	27	brush
	28	eyelet
	29	coin
	30	striker
	31	nail
	32	bone
	33	lamp chimney
	34	flint
	35	lid
	36	drinking glass
	37	mug
	38	basin
	39	handle
	40	pin
	41	tooth
	42	buckle
	43	scale
	44	stake
	45	peach pit
	46	cap
	47	breastplate
	48	shoe
	49	jar
	50	peg
	51	spout
	52	hinge
	53	disc
	54	comb
	55	strip
	56	doorknob
	57	penny
	58	quarter
	59	sheet
	60	napkin ring
	61	rib
	62	frog
	63	spring
	64	bar
	65	touchhole cleaner
	66	emblem
	67	insulator
	68	electrical socket
	69	tile

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
7. Condition	1	complete
	2	fragment
8. Type	00	undetermined
	01	medicine
	02	wine
	03	beer
	04	soft drink
	05	cream
	06	milk
	07	palmetto
	08	pine
	09	cup
	10	saucer
	11	serving platter
	12	dinner plate
	13	bowl
	14	flat glass
	15	butter dish
	16	commode/chamberpot
	17	gravy boat
	18	musket/rifle
	19	whisk broom
	20	spur
	21	stem
	22	bowl
	23	frosted glass
	24	roofing
	25	liquor
	26	drinking
	27	tooth
	28	hair
	29	hipped
	30	clothes
	31	vase
	32	Liberty Head
	33	coffee or tea pot
	34	light fixture
	35	crock
	36	aboriginal
	37	animal
	38	shaving
	39	pitcher
	40	washing
	41	minie ball
	42	bronze
	43	copper
	44	fish
	45	eating utensil
	46	brandy-type collar

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
8. Type (con.)	47	pistol
	48	shoe
	49	knife
	50	knob
	51	seasoning shaker
	52	perfume
	53	mother-of-pearl
	54	seated Liberty
	55	canning jar
	56	cartridge box
	57	tool
	58	dispensary
	59	mirror
9. Color	0	does not apply
	1	clear
	2	aqua
	3	amber
	4	green
	5	violet
	6	none
	7	brown
	8	blue
	9	milk (white)
10. Modeling Modifications	0	none
	1	scalloped
	2	incised
	3	relief molded
	4	beaded
	5	fluted
	6	flanged
	7	scrolled
	8	ridged
	9	flared
11. Paste	0	undetermined
	1	none
	2	hard
	3	soft
12. Paste Color	0	undetermined
	1	red
	2	buff
	3	white
	4	yellow
	5	none
	6	cream
	7	grey
	8	salmon
	9	mocha

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
13. Treatment	0	undetermined
	1	stoneware
	2	earthenware
	3	porcelain
	4	kaolin
	5	jasperware
14. Glaze	0	undetermined
	1	lead
	2	tin
	3	salt
	4	manganese
	5	
	6	unglazed
	7	none
	8	green
	9	blue
15. Glaze Location	0	undetermined
	1	none
	2	interior
	3	exterior
	4	both
16. Surface Modifications	00	none
	01	undetermined
	02	blue transfer
	03	annular
	04	hand painted
	05	finger painted
	06	red transfer
	07	black transfer
	08	banded
	09	yellow slip
	10	brown slip
	11	green featheredge
	12	blue featheredge
	13	purple transfer
	14	red slip
	15	grey slip
	16	buff slip
	17	polychrome
	18	brown transfer
	19	green transfer
	20	cream slip
	21	mocha
	22	ochre
	23	blue slip
	24	green slip

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
16. Surface Modifications (con.)	25	spatter blue
	26	brown trail
	27	brown drawings
	28	black slip
	29	tan slip
	30	pink trim
	31	gold trim
	32	brown asterisks
	33	cord-marked
	34	blue trim
	35	scratched blue
	36	blue and grey slips
	37	brown speckle
	38	brown matte
	39	yellow trail
	40	pink wash
	41	purple trim
	42	mottled
	43	brown trim
	44	marbelized
	45	pink slip
	46	orange transfer
	47	banded and speckled
17. Motif	0	none
	1	undetermined
	2	Oriental
	3	floral
	4	pastoral
	5	commemorative
	6	undetermined
	7	hatched
	8	flow design
	9	paisley
18. Placement	00	none
	01	undetermined
	02	interior
	03	rim interior
	04	lip
	05	body interior
	06	exterior
	07	interior and exterior
	08	base
	09	body
	10	shoulder
	11	neck
	12	spur

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
18. Placement(cont.)	13	stem
	14	bowl
	15	lid
	16	rim exterior
	17	bottom
	18	bowl and stem
	19	foot
	20	underside
	21	below rim
	22	beyond last tooth (ref. to comb)
	23	front
	24	eagle front, inscription back
	25	bowl and spur
	26	handle
	27	facets
19. Bottle Form	00	none
	01	undetermined
	02	see figure 36
	03	see figure 36
	04	modern liquor
	05	see figure 36
	06	modern soft drink
	07	see figure 37
	08	see figure 37
	09	see figure 38
	10	see figure 38
	11	see figure 39
	12	see figure 39
	13	see figure 40
	14	see figure 40
	15	see figure 41
	16	see figure 41
	17	see figure 41
	18	see figure 42
	19	see figure 42
	20	modern medicine
	21	see figure 43
	22	see figure 43
	23	see figure 44
	24	see figure 44
	25	perfume
	26	see figure 45
	27	see figure 45
20. Inscription	00	none
	01	undetermined
	02	"RDNAMEN"
	03	"ILA"

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
20. Inscription (con.)	04	"guaranteed"
	05	"N"
	06	"D'ES"
	07	"R"
	08	"L" "N" "S" E R
	09	"__OTT BE SO"
	10	grape cluster design
	11	gadrooned
	12	two raised rings
	13	"A. COGHILL" "GLASCOW"
	14	"A B CD" B4 C
	15	"I" "R"
	16	gadroons rectangles with three dots near ends.
	17	alternating thick and thin gadroons-- mold marks have 0.6-inch diagonal hash marks.
	18	"Charleston, S. C."
	19	"ARS"
	20	gadroons, 13 stars around bowl, fern mold marks with 6 leaves on each branch, stem has bar and dot design.
	21	"HDLL__", "NO 14 St. M"
	22	finely detailed ferns with dot at side of each fern leaf.
	23	gadroons and ferns
	24	floral pattern along mold mark, raised "R" on stem.
	25	seven fragments: #1 "ND'S" #2 "CE" #3 "S" #4 "TAR" #5 "IND" #6 "PAR" #7 "N"
	26	verticle line decoration from foot to base.
	27	"AR"
	28	"Philadelphia"
	29	"E. P. JR. & CO."
	30	"TH-BR CHARL"
	31	"VERMONT"
	32	floral mold marks, grapes on bowl, spur with initial "R" on both sides of spur.

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
20. Inscription (con.)	33	gadroons, "R" on both sides of spur
	34	tooled rim, fluting with beaded staff, very fine workmanship.
	35	wavy design
	36	gadroons, spur with raised dot on both sides.
	37	gadrooned, candelabra design
	38	"LIEV"
	39	embossed line design extending from mold mark.
	40	"N"
	41	"Eviton" "OW250V"
	42	"BC"
	43	"TE"
	44	gadroons, floral mold marks, "L" "F" on sides of mold mark, stars embossed around rim of bowl, three notches at pipestem base on both sides of stem.
	45	gadroons, stars on spurs
	46	gadroons, "I" on left, horizontal short lines along mold mark.
	47	ferns on mold mark
	48	floral pattern on mold mark
	49	"LFQC"
	50	two different bar and dot designs-- two cartouches with script "MB", "TD", "IN", "HA"
	51	gadroons with bar and dot design
	52	four raised rings at bowl base, notched along bottom mold mark, gadroons.
	53	"SC"
	54	baseball stitch design on mold mark
	55	twig and leaf design
	56	"Giselo" incision--a flower on base and top.
	57	"GEORGIA" (written in an arc)
	58	"MASS"
	59	baseball stitch mold marks, grapes on bowl.
	60	raised lettering "MURE" top, "HERMITAGE" bottom, grape cluster center.
	61	cannon and eagle, "REGT."
	62	eagle grasping arrows and olive branch, shield on chest with "A", back "Scovill & Co."

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
20. Inscription (con.)	63	"BOURNE/REPROOF"
	64	"TAL BIRDS" "aqua china" "JWR"
	65	decorated with stars circling rim, verticle gadroons encircle bowl, baseball stitch from lip to foot.
	66	"I. B."
	67	gadroons and fern pattern
	68	"Dispensary", crossed logs, "SC"
	69	"Not to be Sold"
	70	"E. GERMANIA BREWING CO." "G" "...SC"
	71	"1"
	72	"C. C. 5G. C. O."
	73	"BARTHOLMAY" arc, over winged spoked wheel, "ROCHESTER, NY" arced under wheel.
	74	"Frank S. Terry's Bottling Works, Charleston, S. C. THIS BOTTLE NOT TO BE SOLD" "6" or "9" base.
	75	"LIME COLA 6 1/2 FL. OZ." on shoulder, "THIS BOTTLE NEVER SOLD, CHARLESTON, S. C." on side, "LIME COLA" on bottom.
	76	"GBS" "BALTIMORE, MD." "TRADE MARK"
	77	"NU-GRAPE" applied or painted label
	78	"FEDERAL LAW FORBIDS SALE OR RE-USE OF THIS BOTTLE" in ring around entire lower shoulder.
	79	"Georgius Rex" at top of portrait
	80	ferns and grapes
	81	obverse: embossed eagle grasping olive branch and arrows, shield on chest barely visible. reverse: ellipse of stars around shank, script reads "L. HAYDEN & SCOVILL".
	82	eagle facing left perched on cannon pointing right, "CORPS" underneath.
	83	bar and dot
	84	"T" and "A"
	85	"VMM" (Vol. Militia of Maine)
	86	"US"
	87	eagle facing right, three arrows in left talon, olive branch in right talon.
	88	"Inscetion Brou"
	89	button: circular wreath around eye fragment.
	90	artillery button, scroll style elliptical eye, "A" with #1 under- neath. Ref. S. Luscomb, <u>Collector's</u> <u>Ency. of Buttons.</u>

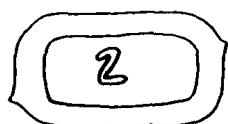
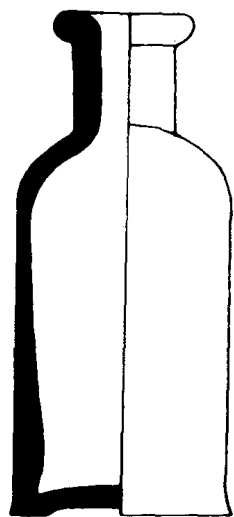
<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
20. Inscription (con.)	91	"Scovill-Waterbury" on back; "S" or Sanders type two part button. Eagle with small wings, three arrows in left claw, branch in right. No shield mark visible (corroded). See Fort Pierce Collection, Carl J. Claussen, p. 7, fig. 5a.
	92	vest button "O" type with eagle and shield with "A" on it, three arrows in left talon, branch in right. Circle around eye with asterisks at top and letters "RR" at base.
	93	domed brass button with embossed eagle. Head faces toward left, left talon unable to see, right has cluster of three arrows, no shield.
	94	front: "Palmetto Brewing Co. Charleston, S. C.", large "P" in center; underneath "This Bottle Not To Be Sold".
	95	"LA"
	96	"E.U.S.", "E.P. JR. & CO."
	97	"E.P. JR. & CO."
	98	"GLASCOW" in rectangle stamped on one side of stem and unidentified mark stamped in rectangle on other side.
	99	"GLASGO" engraved on one side, "COCKILL" on other.
21. Technique of Inscription	0	none
	1	undetermined
	2	engraved
	3	incised
	4	embossed
	5	applied
22. Maker's Marks	0	none
	1	absent
	2	present
23. Monograms	00	none
	01	undetermined
	02	"MGL"
	03	skull and crossbones in triangle

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
23. Monograms (con.)	04	"T.D."
	05	"M" on left side
	06	"ANOVA"
	07	"Brussels"
	08	"T" cartouche in shield
	09	"F"
	10	eagle in circle, script around circle "Warranted"... "ORDSHIRE".
	11	"Adams"
	12	union marks with circular waves (ball in diamond).
	13	partial maker's mark--"Porcelain de Ter..." "Trade Mark ____" and coat of arms.
	14	impressed anchor with two bars through shank.
	15	pressed design in diamond motif; bottom edge stamped with "CONTINENTAL DISTRIBUTING CO."
	16	mark "OR"
	17	"DYOTTVILLE GLASS WORKS PHILA."
	18	"LONGPORT"
	19	"Bailey-Walker Q.M.C. 1924"
	20	ridges on neck and seal on back side
	21	#2 on bottom
	22	raised floral design along mold marks of bowl, "R" on one side of spur and "F" on other side.
	23	"QUALITE'...PERTURE" French inscription.
	24	"President Fillmore"
	25	floral mold marks, grapes on bowl
	26	"R.F"
	27	grapes, gadroons and ferns
	28	"PRICE BRISTOL" stamped on bottom
	29	#1 "DYE", "N", "S", "M" #2 "Q1", "()", "IV", "IR DYE"
	30	embossed "W" and either "O" or "C"
	31	egg-shaped bowl supported by fingers of a hand.
	32	incised check design around bowl rim, "15" and gadroon on spur.
	33	"U.S." front, "PHILA_" back
	34	"Meceman & Co., Importers, NY"
	35	crests and "15" stamped on spur
	36	baseball stitch over mold marks; cartouche on sides which resembles a triangle with a design in the center.

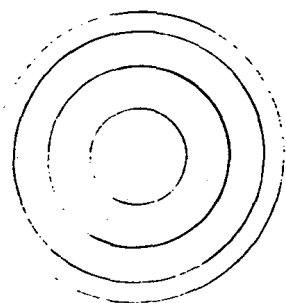
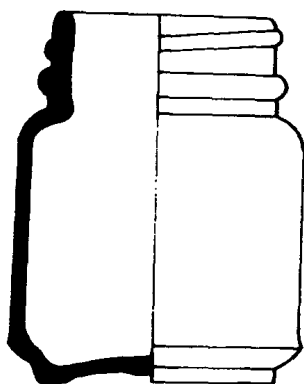
<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
23. Monograms (con.)	37	baseball stitch along mold line with floral design on side.
	38	relief design: two straight lines intersecting at 120° angle.
	39	eagle-head faces left, olive branch in left talon, three arrows in right, stars with ribbing around outer edge.
	40	faintly visible cannon wheel
	41	eagle facing left, olive branch in left talon, three arrows in right, chest shield with "I", "Scovill Co. Waterbury" on back.
	42	same as 41 except back reads only "Extra Quality".
	43	"William"
	44	star and dot design
	45	"UNION GLASS WORKS, PHILA."
	46	eagle facing left, three arrows in right talon, olive branch in left, chest shield with stripes only, script on back "Waterbury Button Co."
	47	fern mold marks, cornstalk design on bowl.
	48	
	49	black glass decorated with spades and diamonds.
	50	"MIV"
	51	"6" embossed on base
	52	mold marks tooled over; familiar TD marking on rear of bowl. Stem above spur is embossed with an "M" on the left (on its side) and a "D" on the left.
	53	fern mold marks, spur has "M" embossed on right side, illegible letter on left side.
	54	"...OFFMAN & SON..." "S" in "SON" is backwards.
	55	"K" on bottom of base
	56	eagle faces right, olive branch in right claw, three arrows in left, "A" on shield. Reverse: "Stele Johnson" with 5-pointed stars between the two words.
	57	olive branch wreath embossed on the bowl rim which circumscribes bowl; 1/2" wide wavy line pattern below wreath which has no significant form.

<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
23. Monograms (con.)	58	fern mold marks, crude grape cluster designs on sides. Distinct "R" embossed on either side of spur.
	59	eagle faces left, olive branch in left talon, three arrows in right, shield contains "A"; reverse has starred perimeter with "R R" at top.
	60	spread-eagle
	61	eagle looks to left, three arrows in right talon, olive branches in left, shield contains stripes only; reverse reads "Scovill & Co. Superfine".
	62	eagle faces left, three arrows in left talon, olive branch in right, shield contains "A"; reverse reads Scovill & Co., Waterbury".
	63	eagle looks to left, three arrows in right talon, olive branch in left, shield has "D".
	64	florentine "I" above "4"
	65	spread-eagle, shield badly worn, back has two concentric circles of stars and dots and "R".
	66	eagle looks left, three arrows in left talon, olive branch in right, shield contains vertical and horizontal stripes, five-pointed stars around perimeter, horizontally striated background.
	67	eagle looks right, three arrows in left claw, olive branch in right, shield with "A", reverse has four concentric circles around eye.
	68	spread-eagle, possible "A" on shield, back has three concentric circles, outer circle of alternating raised dots and 5-pointed stars.
	69	spread-eagle, shield with stars and stripes, back reads "Scovill & Co." "Extra".
	70	cross-hatched design cut into bone
	71	"ION"

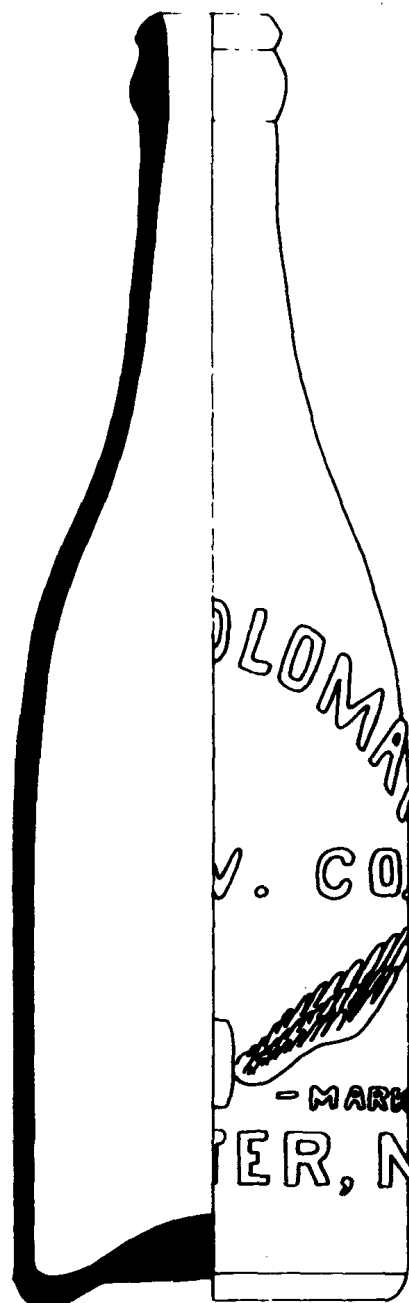
<u>Variable</u>	<u>Code</u>	<u>Explanation</u>
23. Monograms (con.)	72	stamped; American eagle with head facing west, breast has shield with vertical bars on bottom and stripes at top, eagle has floating ribbon in mouth reading "E PLURIBUS UNUM", 13 stars above eagle's head, top of emblem serrated with 16 peaks and valleys, bottom of emblem missing.
	73	"ULTA"
	74	raised palmetto tree design, script "SC".
	75	side "CORRY & CO.", BELFAST" base "WM. CORRY & CO. LTD.", "BELFAST", "8561".
	76	"T" on both sides of spur
	77	bottle #1 "SM" "CH", #2 "CO" "TON"
	78	"C.A.", "A"
	79	"R", "M" on facets
	80	palmetto tree over crossed loop with "S.C. Dispensary" on front, "C.C.Co." on back.
	81	"South Carolina Dispensary", palmetto tree with crossed logs.
	82	"D"
	83	"TE & C CO" "60W, 250"
	84	"THOMAS"
24. Monogram Location	Same as values for Variable #18	
25. Rim Diameter	00000	
26. Foot Diameter	00000	
27. Appendages	0	none
	1	undetermined
	2	handle
	3	spout
	4	wire loop
	5	foot
28. Appendage Location	Same as values for Variable #18	



02



05



03

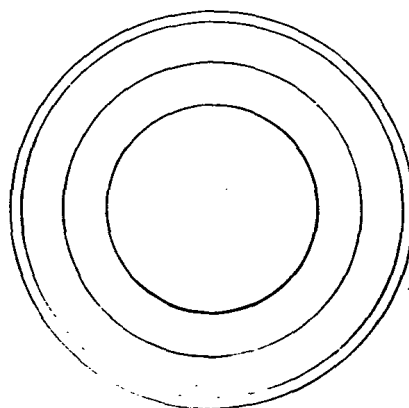
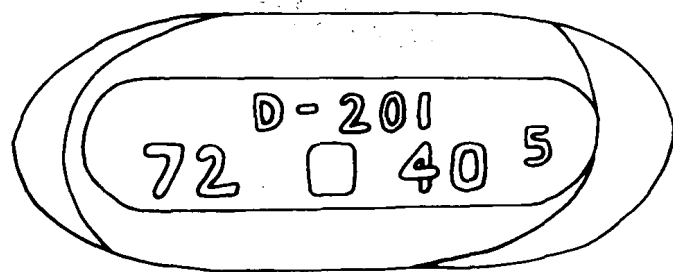
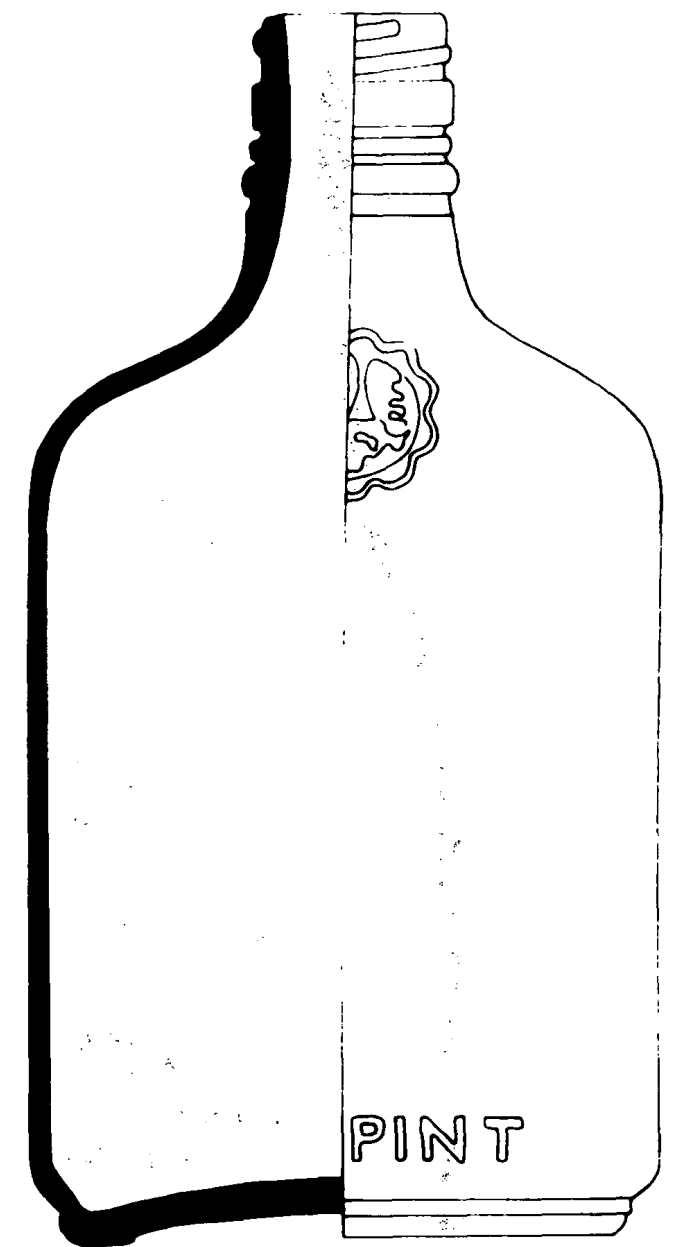
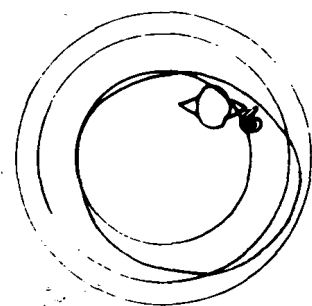
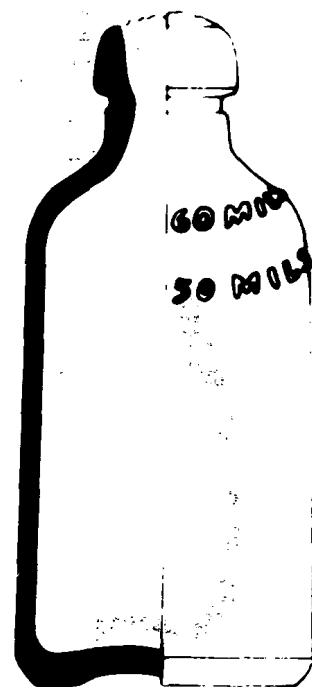


FIGURE 36

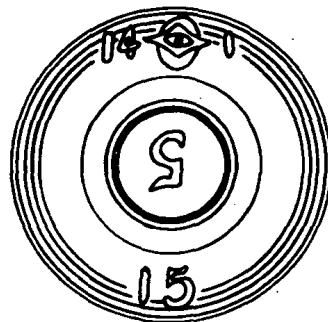
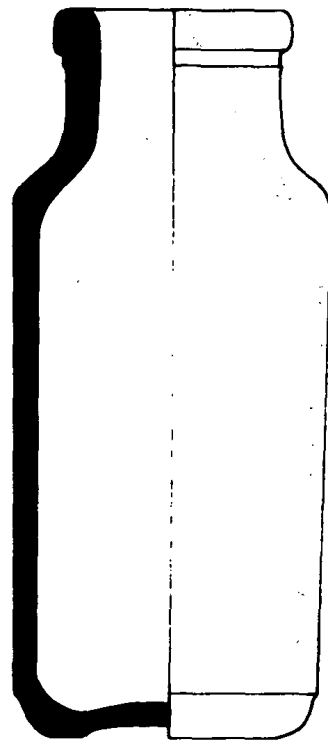
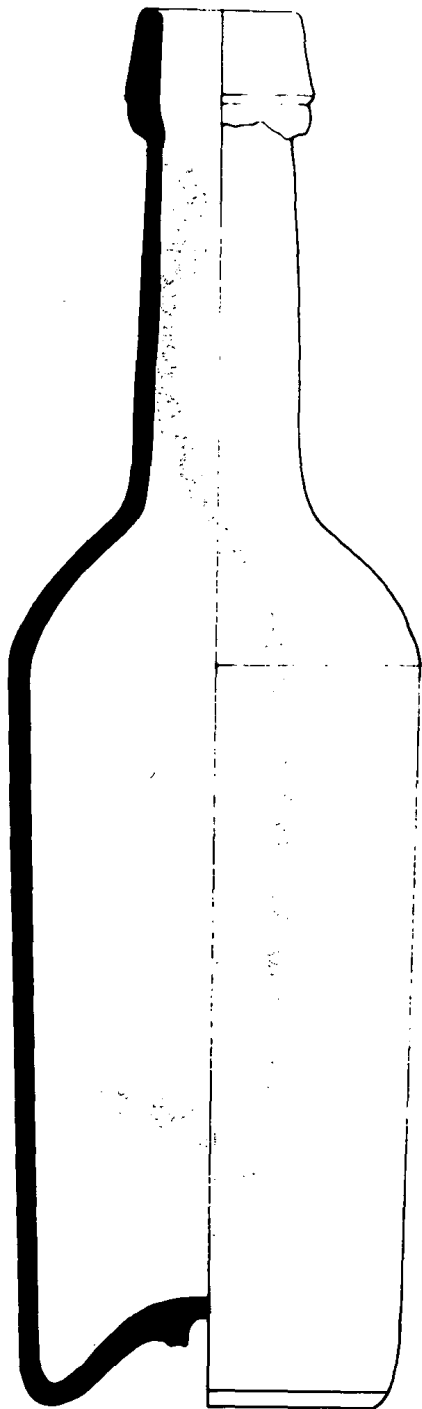


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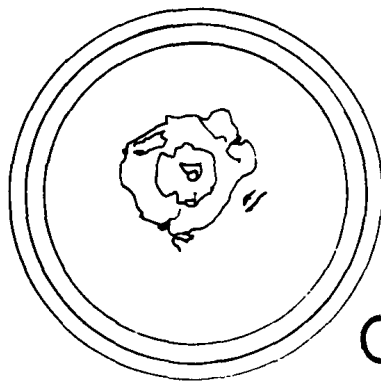


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FIGURE 37

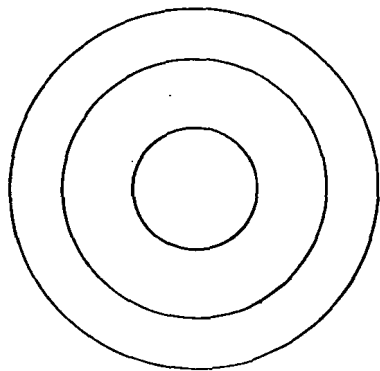
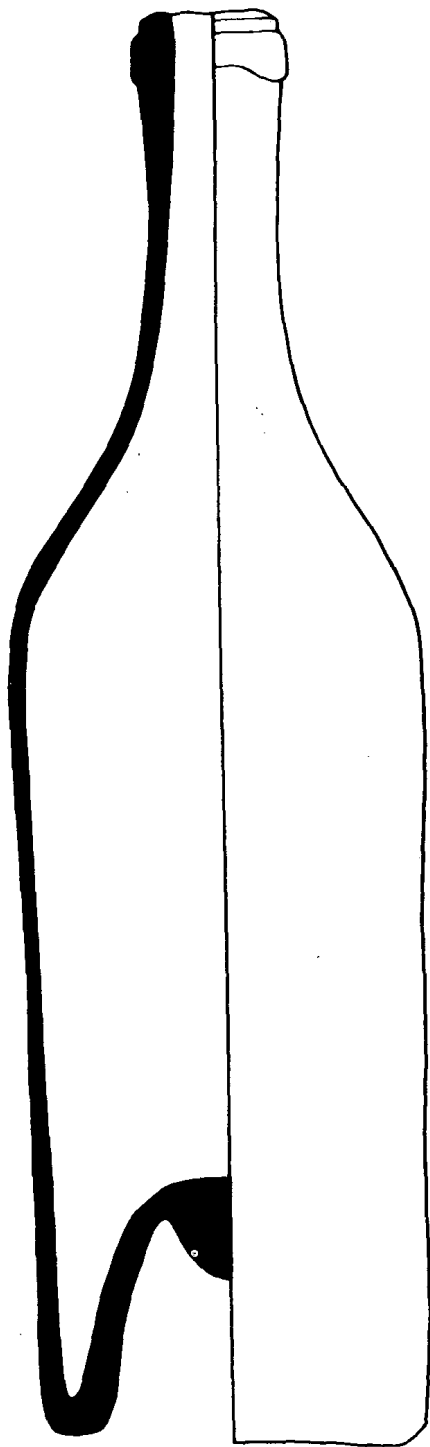


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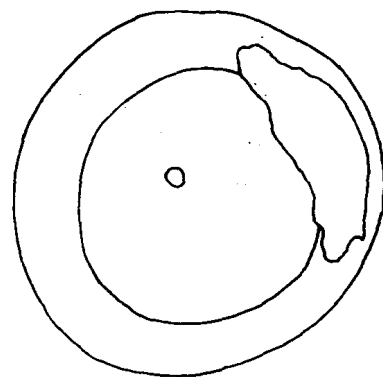


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FIGURE 38

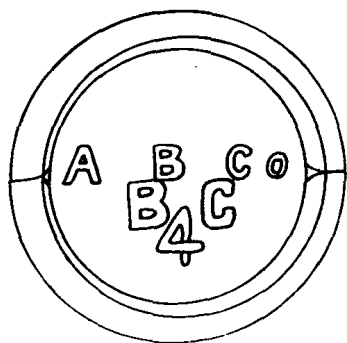
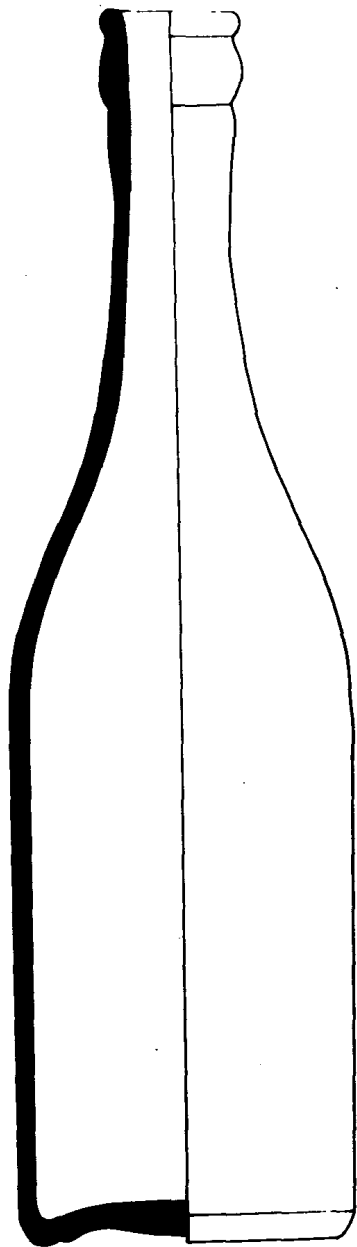


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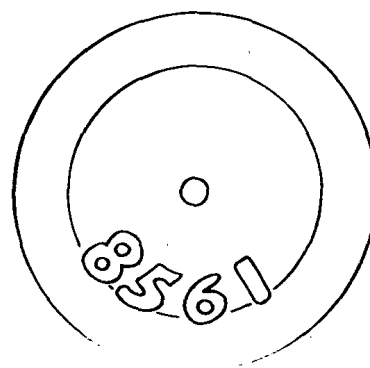


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FIGURE 39

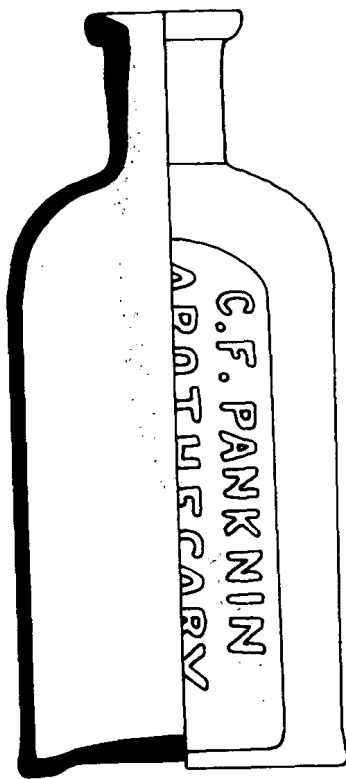


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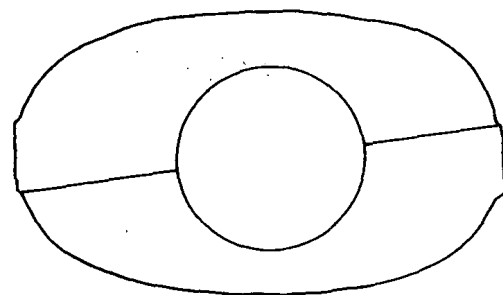
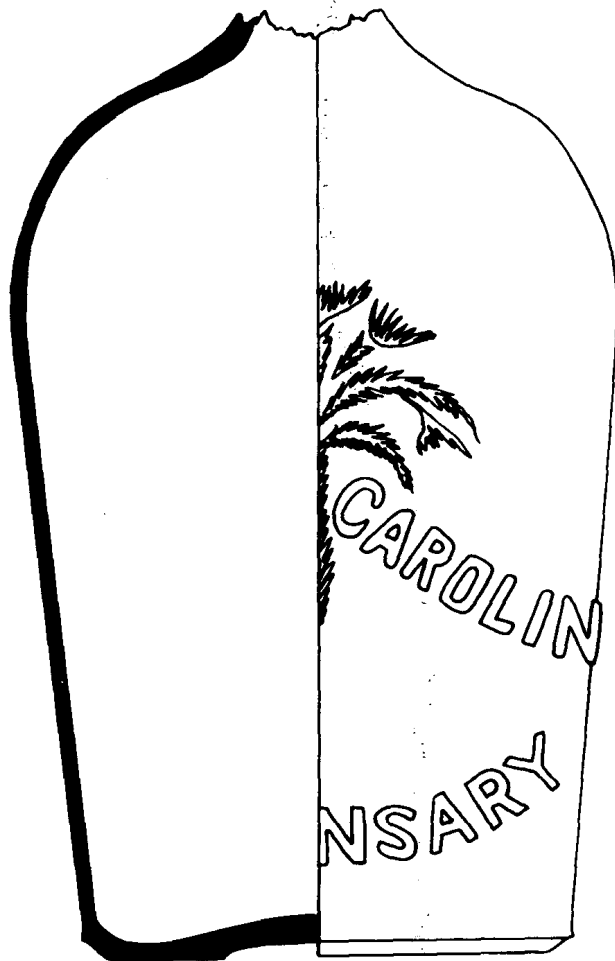
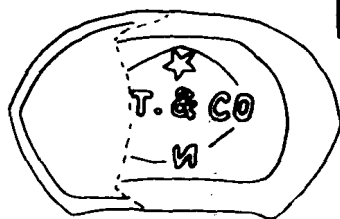


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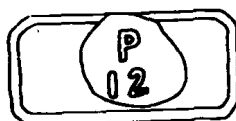
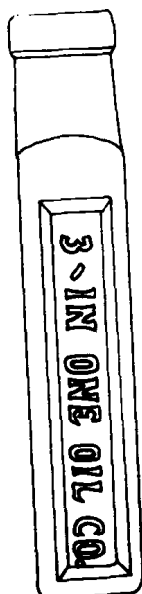
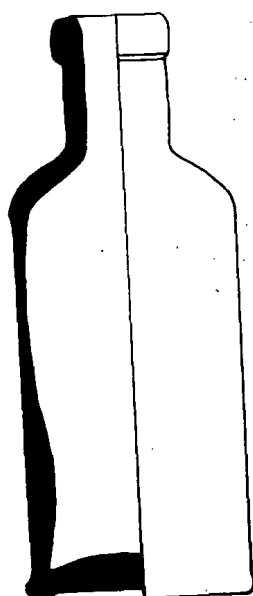
FIGURE 40



15

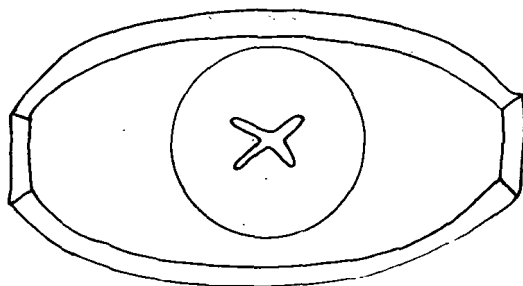
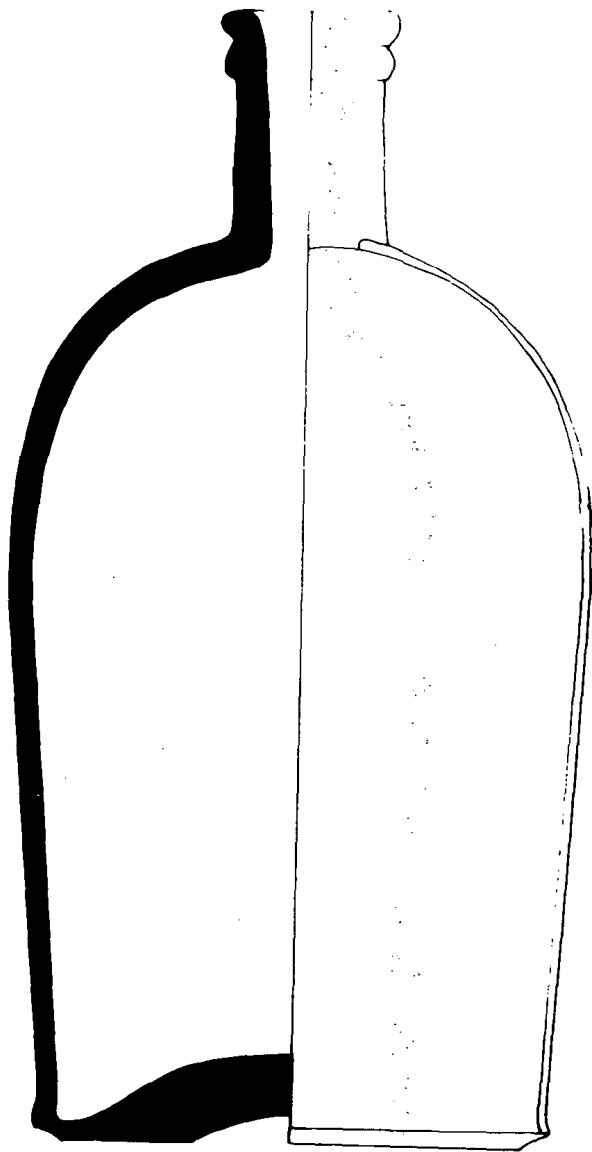


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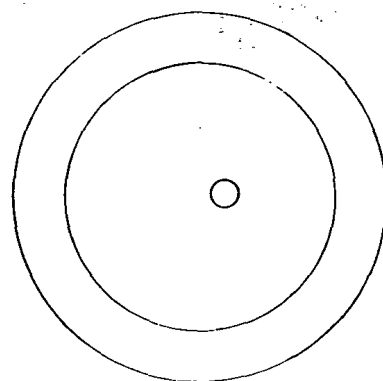


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FIGURE 41

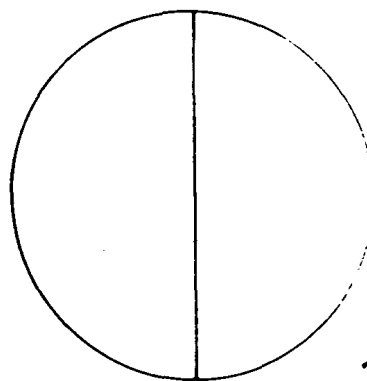
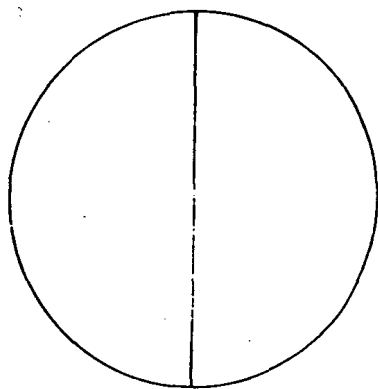
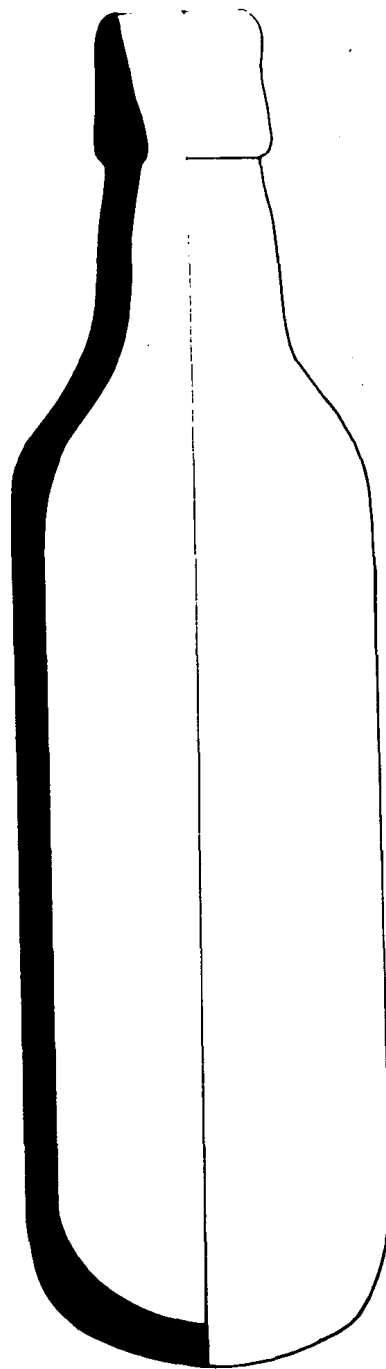
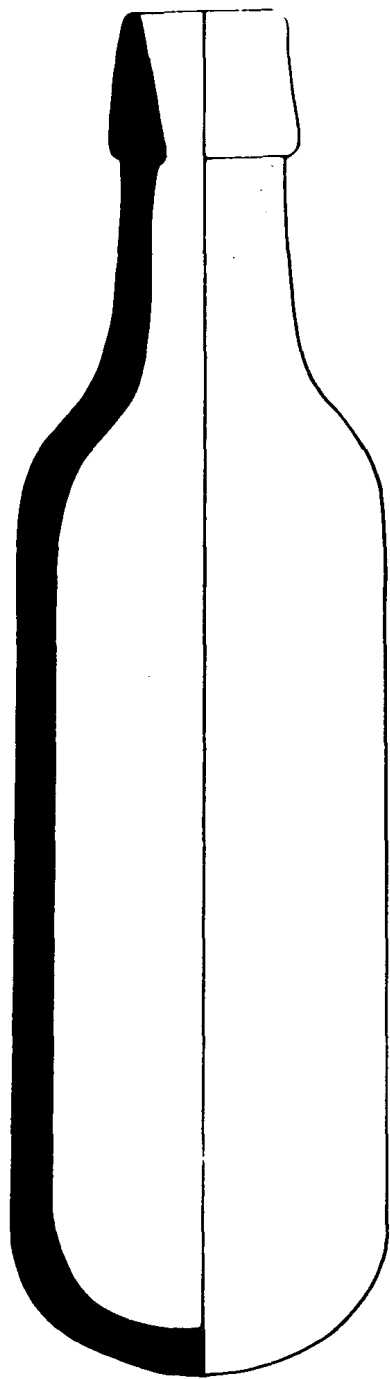


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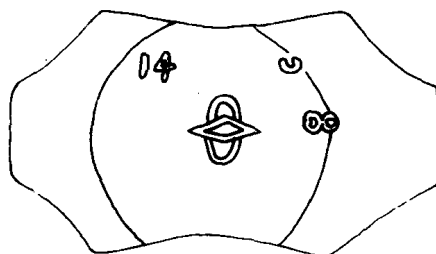
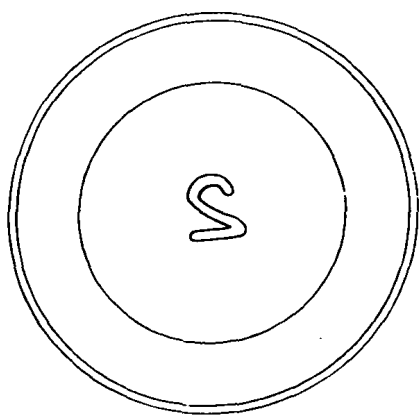
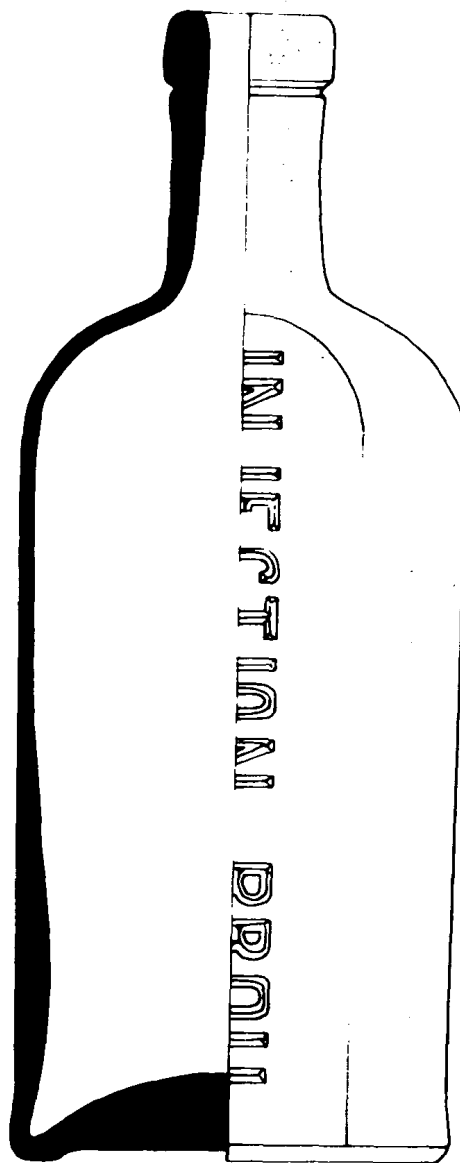
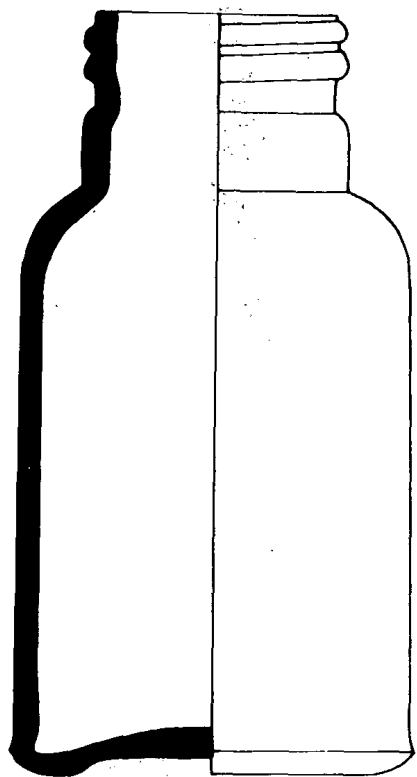
FIGURE 42



21

22

FIGURE 43



23

24

FIGURE 44

APPENDIX D

Faunal Remains

Three hundred and four vertebrate specimens are included in the assemblage from Fort Moultrie. As only minimal amounts of faunal material were recovered in each excavation, each of which exhibited almost no stratigraphy, the material has been analyzed as a single unit. Tables 2, 3, and 4 identify the remains.

The bulk of the sample appears to be the remains of Domestic Cattle (*Bos Taurus*) and Domestic Hog (*Sus Scrofa*). Sheep-Goat (*Ovis/Capra*) remains could not be separated. No evidence of deer was represented in this sample. Miscellaneous faunal remains are identified including Avian, *Canis*, *Equus*, and *Testunidae*.

TABLE 2 Bos Taurus Remains from Fort Moultrie

	Minimum Number of Elements--Left		Minimum Number of Elements--Right		Minimum Number of Elements		Percent of Total Number of Elements (n 146)	Minimum Number of Individuals	Percent of Minimum Number of Individuals (n 9)	Total Number of Elements (minimum)
	Lp	0*	Ld	Rp	0	Rd				
1 Femur	3		5	2	5	5	6.85	5	55.6	10
2 Tibia	3		9	3	9	5	9.59	9	100.0	14
3 Metatarsal	1				1	1f	2.05	3	33.3	3
4 Humerus	2		6	4	5	1s	7.53	6	66.7	11
5 Radius	1		4	2	3	4s	4.79	4	44.4	7
6 Ulna	1		4	3	2		3.42	3	33.3	5
7 Metacarpal		2s		1	1		2.05	2	22.2	3
8 Cuboid		1c			4	3f	4.79	4	44.4	7
9 Calcaneus	3	4f			8	2f	6.85	8	88.9	10
10 Astragalus	1	5f			8	1f	6.85	8	88.9	10
11 Intermediate Carpal		2c			2		1.37	2	22.2	2
12 Radial Carpal						2c	1.37	2	22.2	2
13 Ulnare Carpal						1c	.68	1	11.1	1
14 Second and Third Carpals					2	3c	3.42	3	33.3	5
15 Fourth Carpal					1	1c	.68	1	11.1	1
16 Accessory Carpal		1c					1.37	1	11.1	2
17 Cervical Vertebrae						6a	4.11	1	11.1	6
18 Thoracic Vertebrae						3a	2.05	1	11.1	3
19 Lumbar Vertebrae						3a	2.05	1	11.1	3
20 Sacrum						3a	2.05	1	11.1	3
21 Acetabulum		3f, 1c			4	6f, 1c	7.53	7	77.8	11
22 Ischium		1f			1	1f	1.37	1	11.1	2
23 Ilium		1f			1	1f	1.37	1	11.1	2
24 Mandible			2		2	1f	3.42	3	33.3	5
25 Scapula	1	5af			5	3df	6.85	5	55.6	10
26 First Phalanx		1c			1	2f	2.05	2	22.2	3
27 Second Phalanx		1c			1	1f	1.37	1	11.1	2
28 Patella		1c			1	2c	2.05	2	22.2	3

TOTAL

146

*Other--includes Fragments (f), Shaft Fragments (s), Axial Elements (a), Complete Elements (c); p--proximal, d--distal.

Table 1 includes Bos material for the entire sample examined.

Vertical Columns 1 and 2 give the minimum number of elements represented by side as well as proximal, distal, fragmentary, or complete.

Vertical Column 3 gives the minimum number of elements represented by side (L and R), combining all fragments, proximals, distals, and completes.

Vertical Column 4 gives the percentage of the entire sample represented by each element.

Vertical Column 5 gives the minimum number of individuals represented, determined by Column 3 and visual inspection of the individual elements.

Vertical Column 6 gives the percent of the largest number in Column 5 for each individual element.

Vertical Column 7 gives the total of L, C, and R of Column 3.

TABLE 3 Sus Scrofa Remains from Fort Moultrie

	Minimum Number of Elements--Left			Minimum Number of Elements--Right			Minimum Number of Elements		Percent of Total Number of Elements (n 88)	Minimum Number of Individuals	Percent of Minimum Number of Individuals (n 8)	Total Number of Elements (minimum)
	Lp	O*	Id	Rp	O	Rd	Left	Right				
1 Femur	2		4ds	2	2c, 2a	1	4	4	9.09	4	50.00	8
2 Tibia				4			2	4	6.82	4	50.00	6
3 Humerus			ls	2	7ds	2	3	4	11.36	7	87.50	10
4 Radius	1		2a, 1c	3	1a		3	4	7.95	4	50.00	9
5 Ulna			1c	8			1	8	10.23	8	100.00	9
6 Scapula					1f	3	4	3	7.95	4	50.00	7
7 Calcaneum			3c		1c		3	1	4.55	3	37.50	4
8 Astragalus			1c				1		1.14	1	12.50	1
9 Central Tarsal			1c				1		1.14	1	12.50	1
10 Fourth Tarsal			1c				1		1.14	1	12.50	1
11 Intermediate Carpal					1c			1	1.14	1	12.50	1
12 Cervical Vertebrae									1.14	1	12.50	1
13 Thoracic Vertebrae									3.41	1	12.50	1
14 Lumbar Vertebrae									7.95	4	12.50	4
15 Acetabulum			3f		4f		3	4	7.95	4	50.00	3
16 Sacrum									1.14	1	12.50	1
17 Fibula									2.27	1	12.50	2
18 Fourth Metacarpal									1.14	1	12.50	1
19 Third Metacarpal					1c		1	1	2.27	1	12.50	2
20 Fifth Metacarpal	1				1c		1	1	2.27	1	12.50	1
21 Fourth Metatarsal				1					1.14	1	12.50	1
22 Third Metatarsal								1	1.14	1	12.50	1
23 Phalange (first)			1c				1	1	1.14	1	12.50	1
24 Phalange (second)								2	2.27	1	12.50	1
25 Mandible	1		2f		2c		2	2	3.41	2	25.00	3
26 Maxilla			3f		1f		2	1	3.41	2	25.00	3
TOTAL												

TOTAL

*Other--includes Fragments (f), Shaft Fragments (s), Axial Fragments (a), Complete Elements(c); p--proximal, d--distal.
Table 2 includes Sus material for the entire sample examined.

Vertical Columns 1 and 2 give the minimum number of elements represented by side as well as proximal, distal, fragmentary, or complete.

Vertical Column 3 gives the minimum number of elements represented by side (L and R), combining all fragments, proximals, distals, and completes.

Vertical Column 4 gives the percentage of the entire sample represented by each element.

Vertical Column 5 gives the minimum number of individuals represented, determined by Column 3 and visual inspection of the individual elements.

Vertical Column 6 gives the percent of the largest number in Column 5 for each individual element.

Vertical Column 7 gives the total of L, O, and R of Column 3.

TABLE 4 Miscellaneous Faunal Remains from Fort Moultrie

	Minimum Number of Elements—Left			Minimum Number of Elements—Right			Minimum Number of Elements		Minimum Number of Individuals	Total Number of Elements (minimum)
	lp	0*	ld	rp	0	rd	left	right		
OVIS/CAPRA (sheep-goat)										
1 Femur (pos. Ovis)	2			1f			2		2	2
2 Femur		1					1	1	1	2
3 Radius	1						1	1	1	1
4 Metatarsal	1			2			1	2	2	3
5 Astragalus (pos. Ovis)							1	1	1	1
6 Humerus (cf. Ovis)					1		1	1	1	1
7 Humerus					1		1	1	1	1
8 Tibia	1	1s	2	1s	2		4	3	3	7
9 Scapula							1	1	1	1
10 Atlas		1s		1s			1	1	1	2
11 Acetabulum				2f				2	1	2
12 First Metacarpal								1	1	1
13 Lumbar Vertebra							1s	1	1	1
TOTAL										26
There is no evidence of any deer represented in this sample.										
MELEAGRIS GALLINAGO (turkey)										
1 Ulna							1		1	1
2 Coracoid							1	1	1	1
3 Cervical Vertebra								1s	1	1
TOTAL										3
GALLUS SP. (chicken)										
1 Femur							1		1	1
2 Tarso-metatarsus							1	1	1	1
3 Carpo-metacarpus							1	1	1	1
4 Radius							1	1	1	1
TOTAL										4
COLUMBIFORMES (pigeon, dove—order)										
1 Tibiotarsus							1		1	1
2 Femur							1	1	1	1
TOTAL										2
GRUIFORMES (cranes, coots, rails—order)										
1 Tibiotarsus				1				1	1	1
TOTAL										1
CANIS SP. (dog/wolf)										
1 Ulna				1				1	1	1
2 Tibia				1				1	1	1
3 Mandible								1	1	1
TOTAL										3
EQUUS (horse)										
1 Radius							1		1	1
2 Humerus		1					1	1	1	1
3 First Phalanx								1s	1	1
4 Second or Fourth Phalanx								1s	1	1
5 Tibia								1	1	1
TOTAL										5
TESTUDINAE (turtles)										
1 Fragments							45f		1**	45
2 Carapace Sections							9f		1	9
3 Carapace Fragments							2f		1	2
TOTAL										56
**Three individual turtles from three different proveniences.										
ASTACIDAE (crayfish sp.)										
1 Minor Fragments							3f		1	3
TOTAL										3
ICHTHYOIDEA (fish)										
1 Vertebrae								2s	1	2
2 rostral Spine							1		1	1
TOTAL										3

*other--includes Fragments (f), Shaft Fragments (s), Axial Fragments (a), Complete Elements (c); p--proximal, d--distal

Table 2 includes all miscellaneous faunal remains for the entire sample examined.

Vertical Column 1 and 2 give the minimum number of elements represented by side as well as proximal, distal, fragmentary, or complete.

Vertical Column 3 gives the minimum number of elements represented by side 1 and 2, combining all fragments, proximals, distals, and completes.

Vertical Column 4 gives the minimum number of individuals represented, determined by Column 3 and visual inspection of the individual elements.

Vertical Column 5 gives the total of 1, 2, and 3 of Column 3.

APPENDIX E

Soil Resistivity Study of Fort Moultrie II

The structural remains of Fort Moultrie II appear to lie entirely to the south of the present fort. The extremely high water table makes any excavation in the area exceedingly difficult and costly. Combes' soil resistivity survey and numerous engineers' maps seem to confirm within a few yards the location of Moultrie II. We do not feel that additional excavations would produce enough data to justify the funds necessary to cope with elements. The shoreline has advanced and retreated over the area at least once and we haven't any idea how rapidly the advance or retreat was. Wave action may have destroyed all but the deepest footings; any remaining cultural material has been thoroughly mixed from original context.

Although the official army records claimed complete obliteration of many of the earlier structures in Fort Moultrie III and the parade ground, the demolition of the structures was only to the pre-existing ground level. Archeological evidence was more abundant than first anticipated.

Massive earth-moving activities during and after the Civil War completely mixed the artifacts from three centuries. Only the artifacts on the parade inside the fort were in situ. These appear to have been deposited in 1865 or later as the military buttons and insignias were all from Union uniforms. Lack of identifiable Confederate Army items may be the result of souvenir hunting shortly after

the fort was recaptured. No privies or garbage dumps were encountered during the excavation; therefore, there was no data to interpret the life-style of the troops.

The National Park Service archeologist was instructed to determine, if possible, the location of Moultrie II foundations. Historical information suggests that these remains were most likely to be found in the area south of the present Fort Moultrie structure and the sea. A purchase order was negotiated with John D. Combes of the Institute of Archeology and Anthropology of the University of South Carolina, Columbia, South Carolina to conduct a soil resistivity study of the area in question. Mr. Combes' study is presented in the following pages.

A SOIL RESISTIVITY SEARCH FOR ARCHAEOLOGICAL REMAINS
OF FORT MOULTRIE II

by
John D. Combes

In the early summer of 1974 the writer was contacted by the National Park Service and asked to attempt to locate remains of Fort Moultrie II at the Fort Moultrie site. This study was undertaken in July. The area of interest is located south of the existing Fort Moultrie (1808) structures and includes an area about 250 feet square. This location consists primarily of sand fill, and the old surface was expected to be located at a depth of approximately 7 feet. The search area was first gridded into 10-foot squares and resistance values were taken at 10-foot intervals. Our objectives were to locate areas of low resistance in an attempt to assist the archaeologist in selecting the locations with the highest probability of locating evidence of Fort Moultrie II.

The use of resistivity data for the purpose of archaeological prospecting has not developed into a very often-used tool by archaeologists. This technique has, however, been used for the location of subsurface features for well over a century by geologists with first experimentation having been done over two centuries ago (Van Nostrand 1966). These early applications were concerned for the most part with the location and determination of the extent of ore deposits. Significant contributions were made during the first years of the present century by a Frenchman, Conrad Schlumberger, who did some very successful prospecting for ore bodies. One of the electrode configurations bears his name. The American, Frank Wenner,

is credited with formulating the first clear statement of the mathematical theorem involved in his four-probe method (1915).

Today, some sixty years later, the primary electrode configuration used by geologists is called the "Wenner Method." Another one of his discoveries is highly significant and is of concern to archaeology: the method for determining stratigraphic layering by resistivity measurement.

The last 40 years have brought about many refinements to both the studies and the apparatus for use in geological prospecting. The technique has had some use by archaeologists for the past 20 years but on a limited scope. The first archaeological use was the work of Hans Lundberg of Toronto for Helmut De Terra which resulted in the discovery of the Tepexpan Man in Mexico in the 1940's. The technique was able in this instance to locate the geologic formation the fossil was in and not the fossil itself, but nonetheless it located this important find (De Terro, Romero, Stewart 1949).

M. J. Aitken of the Research Laboratory for Archaeology and History of Art at Oxford is generally credited with most of the pioneering work in archaeology. As early as 1946 he first tried the technique and in 1961 he published the first detailed description of its use and the equipment.

A fundamental property of the material making up the earth's crust, or more specifically the soil, is that of resistivity. It is possible to obtain field resistivity measurements of clays, sands, gravels,

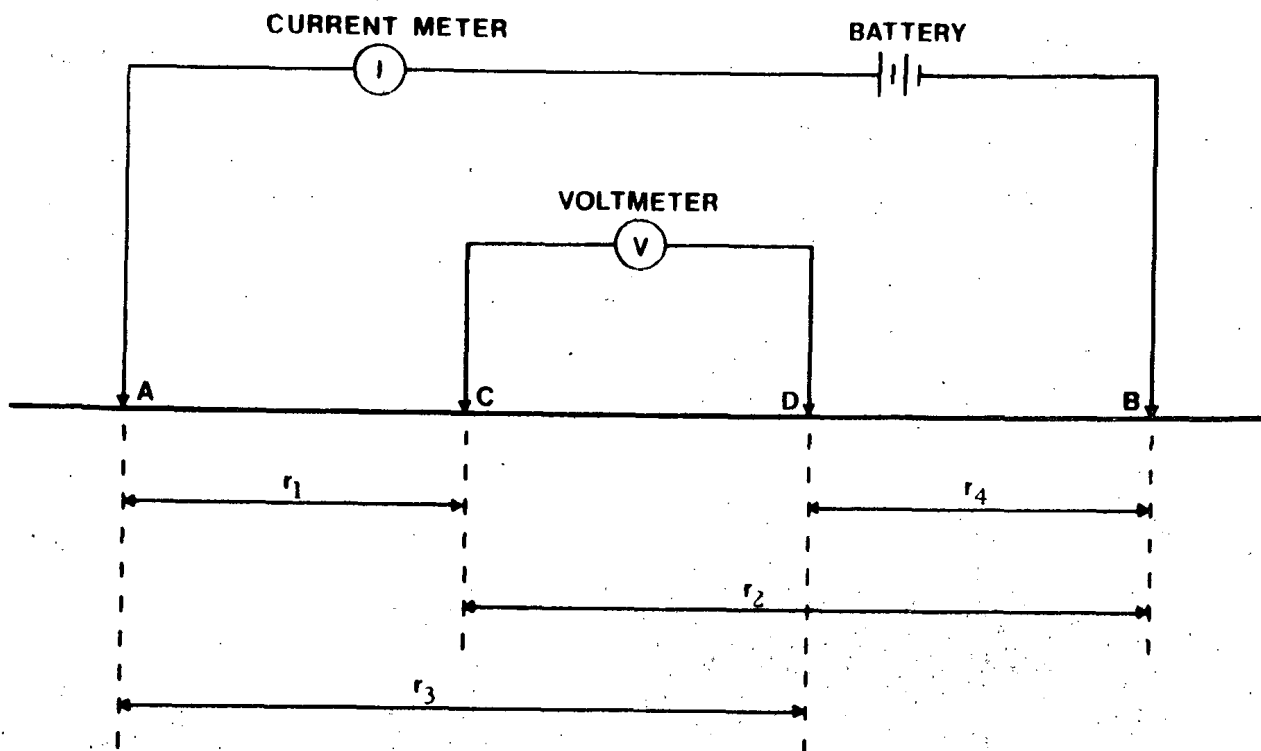
and various sedimentary and igneous rocks. All of these materials have varying resistance values. In general, hard compact rocks are very poor conductors while the more porous rocks such as limestone are much better conductors, though poor when compared to soils, sand, and clay. In the field then one may introduce an electrical current into the ground and measure the resistance at various depths.

Geological work is interested in the finer variations between substances; however, for archaeological applications, it is enough to assume that rocks have high resistance values compared with soils and clays and that wide variation between the latter is observed primarily as a function of their moisture content. Therefore, ancient buried stone walls and roads are excellent examples of archaeological features detectable by resistivity surveying. In addition, earth filled ditches, cellars, burials, or former excavations of any type may be located by this technique. The disturbed fill of any former excavations will usually contain organic matter and perhaps other cultural debris that will produce a difference in conductivity as well as an alteration of the water retaining potential. For archaeological research, primarily as a prospecting tool, resistivity surveying has the potential of becoming an important technique. Fundamentally the archaeological use of the method is the same as the geological use of prospecting for sand and gravel deposits with the only difference being the scale or size of the search and the objective.

The measurement techniques and the major problems are best illustrated by a discussion of a simple two-probe resistivity meter. If one were to insert two metal probes into the ground a few feet apart and connect a battery between them a small current would flow through the ground. By measuring the voltage between the probes and dividing it by the current of the circuit, the total resistance between the probe will be obtained. High or low resistance between the probes indicates an abnormal value when compared to adjacent readings (Aitken 1961).

The simple system described above is not satisfactory for an actual resistivity study. But it does illustrate the principle of the technique. By using four probes and an a.c. power source the difficulties with the system will be overcome. Figure 46 illustrates diagrammatically the popular four-probe configuration and a method to compute the voltage at measuring probes c and d (equation 1 and 2). Equation 3 results from subtracting 1 from 2 and solving for "p". This then is the fundamental equation of the resistivity method and the values are termed apparent resistivity. There are many phenomena affecting this technique for archaeological use which necessitates a good understanding of local conditions and how the instrumentation will record various conditions.

In general, the equipment used by the geologist is not satisfactory for use by the archaeologist. The lack of suitable units and the seemingly complicated nature of its use has kept it from the general



$$V_c = \frac{I\rho}{2\pi} \left(\frac{1}{r_1} - \frac{1}{r_2} \right) \quad (1)$$

$$V_d = \frac{I\rho}{2\pi} \left(\frac{1}{r_3} - \frac{1}{r_4} \right) \quad (2)$$

$$\rho = \frac{2\pi V}{I} \frac{1}{\left(\frac{1}{r_1} - \frac{1}{r_2} \right) - \left(\frac{1}{r_3} - \frac{1}{r_4} \right)} \quad (3)$$

FIGURE 46. A Diagrammatic Illustration of the Popular Four Probe Configuration and a Method to Compute the Apparent Resistance

use of archaeology. New models for archaeology have been introduced, but it is still far from a general acceptance. Recently at the Institute of Archeology and Anthropology at the University of South Carolina the writer and Marshall Williams of the University of Georgia have developed a new two-probe soil resistance measuring device.

The unit consists of a small, lightweight, self-contained, metal box containing the electrical components, two lead wires, and two stainless steel probes. There are two main uses for this apparatus. The first or a "low level" use is designed to rapidly detect, by chance, an archaeological feature in a large unknown area. One merely measures the resistance at given intervals along a line across the field of interest. By inserting the probes and recording the resistance measurements on a graph a resistance profile through the field is obtained. The number and placement of these lines is up to the judgement of the archaeologist and would be based on the situation at hand. A quick inspection of the graph will indicate the presence of a resistance anomaly. In most cases a decrease in resistance will show up where there is evidence of human occupation such as a burial, an ancient house floor, or a midden deposit.

The "high level" use of the instrument is designed for use after the site has been located, and a rather detailed "picture" or "plan view" is desired. Measurements are taken at appropriate intervals in both directions. This enables a two-dimensional view of the subsurface phenomena.

Depth of penetration is a function of probe spacing. Therefore, if the anticipated archaeological remains are thought to be 10 feet deep, probe spacing should be 10 feet, but experience has found that a separation of 1.5 times that distance is more satisfactory.

The unit is basically a resistance bridge circuit, with the unknown resistance (the soil) forming one of the four bridge legs. The output of the bridge is fed into a very sensitive amplifier which drives the indicator meter. When the probes are inserted into the ground the null control is used to null the meter. This setting of the null control is recorded, and another probe insertion is made in the test sequence. If the meter hand moves the null control is used to bring the needle back toward zero. The new reading is recorded. In this manner, an entire series of tests may be plotted.

The results of this study indicate that there is definitely a low resistance region present in the suspected areas (Figure 47). To best visualize the readings obtained a three-dimensional contour map was used called SYMVU, a graphics package developed by Harvard University's Laboratory for Computer Graphics and Spatial Analysis (1971). This package merely generates resistance contours illustrating the resistance highs and lows by "mountains and valleys." There was an unusual array of values collected ranging from 100 ohms to over 80,000 ohms. Figures 48, 49, and 50 are results of the survey using three-dimensional contours. Each figure denotes a different vertical scale (5,000 feet, 10,000 feet and 40,000 feet) and there

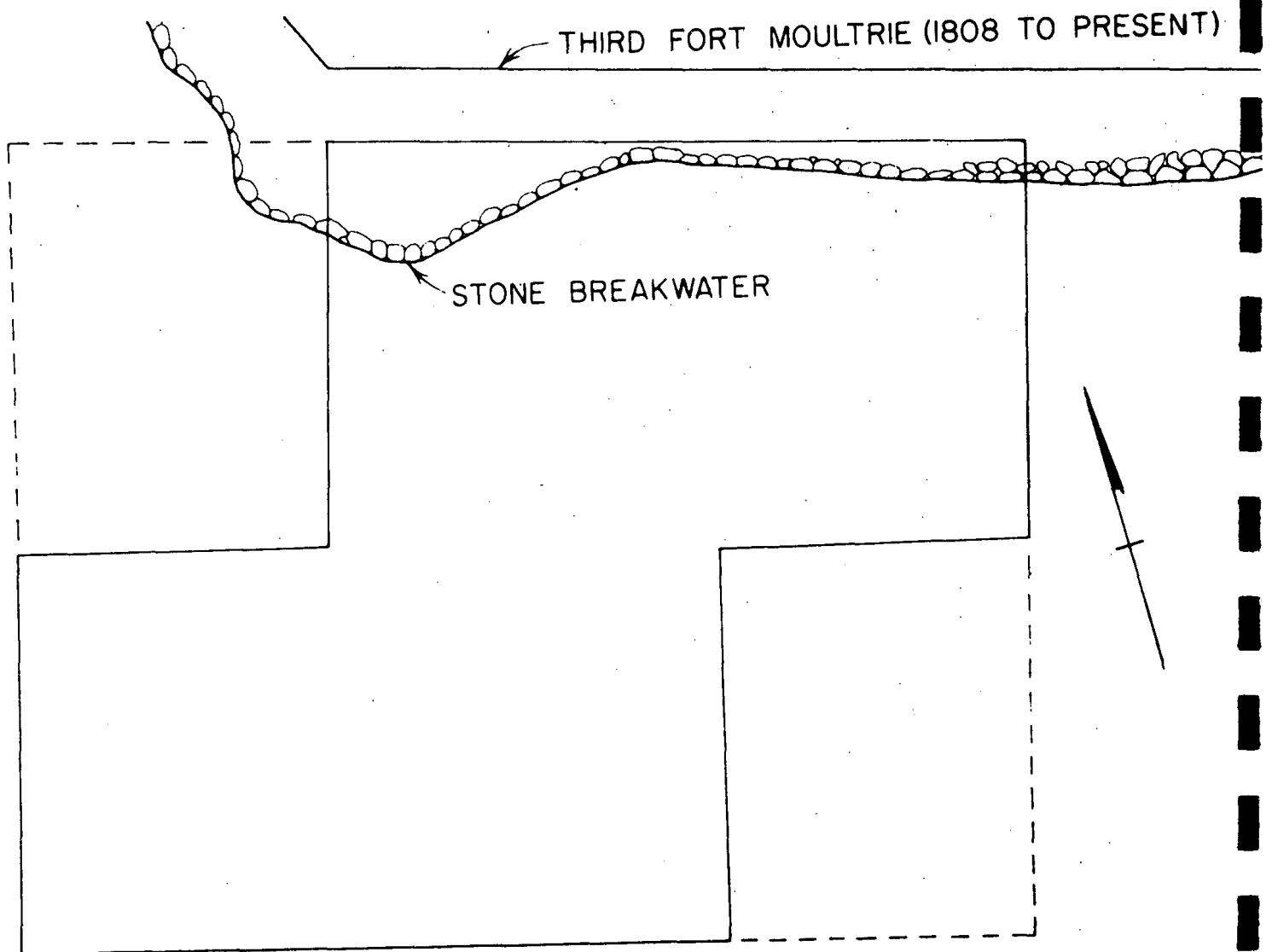


FIGURE 47. The Area Investigated for Resistance Anomalies

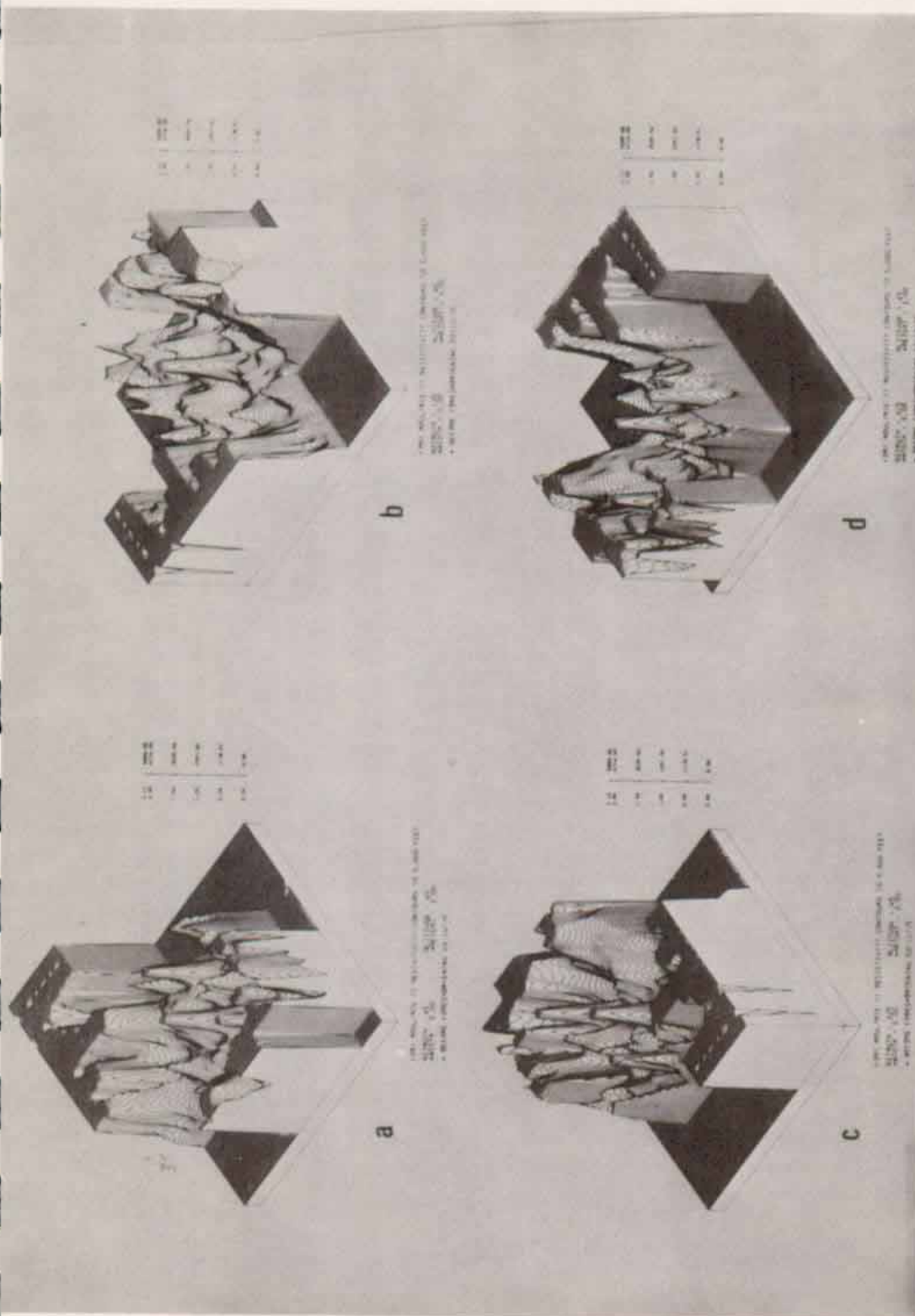


FIGURE 48. A three dimensional resistance contour map of the suspected area of Fort Moultrie II. The upper left hand corner of map a is adjacent to the existing seaward wall of the fort. Map b is rotated 90° counter clockwise, map c is rotated 90° further, map d is 90° further.

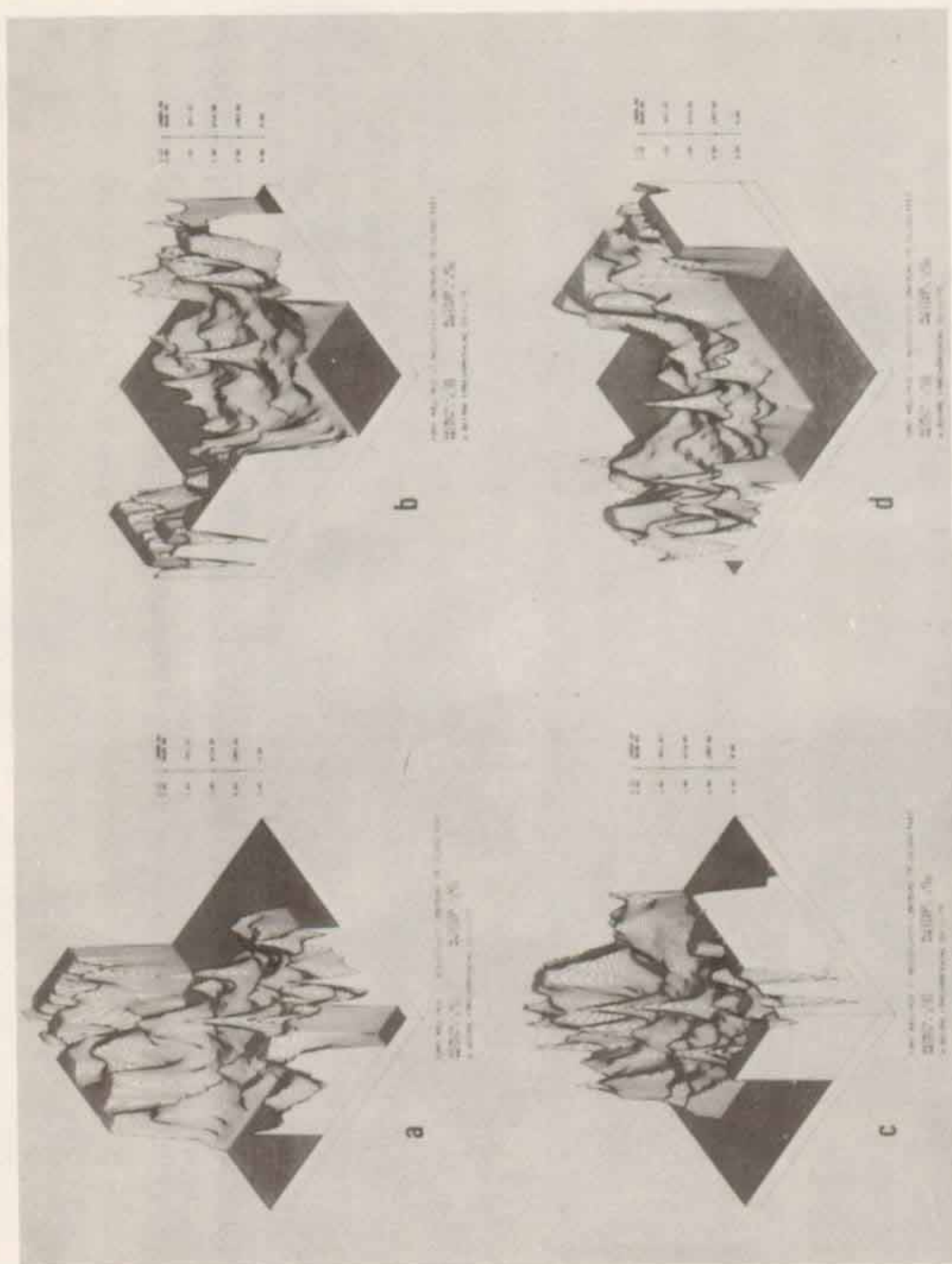


FIGURE 49. A three dimensional resistance contour map of the suspected area of Fort Moultrie II. The upper left hand corner of map a is adjacent to the existing seaward wall of the fort. Map b is rotated 90° counter clockwise, map c is rotated 90° further, map d is 90° further.

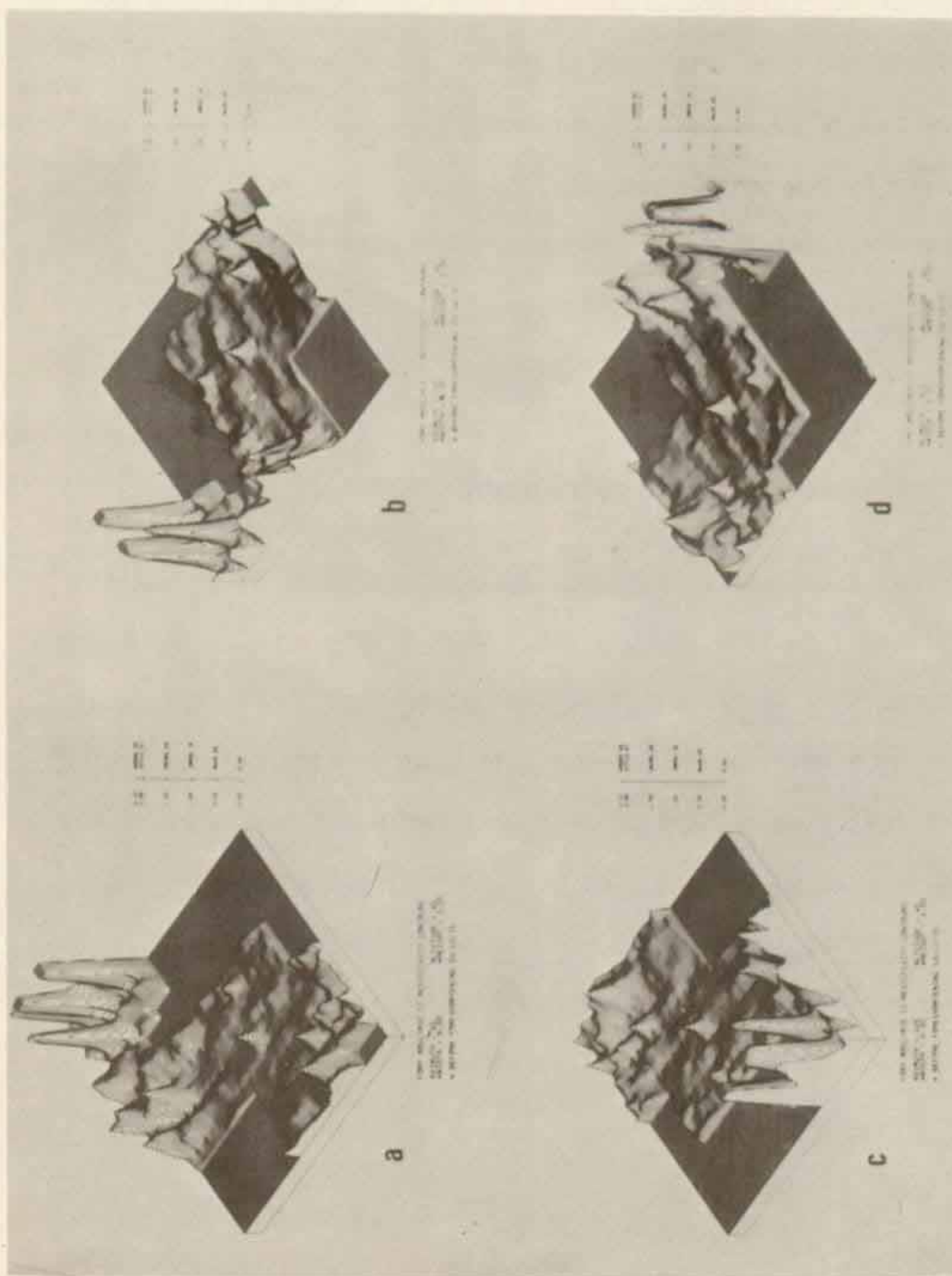


FIGURE 50. A three dimensional resistance contour map of the suspected area of Fort Moultrie II. The upper left hand corner of map a is adjacent to the existing seaward wall of the fort. Map b is rotated 90° counter clockwise, map c is rotated 90° further, map d is 90° further.

are four views of each representing a rotation of 90° . The flat grey low areas represent areas that were not measured during the survey, and the high greys are where the peaks were cut off at whatever top value was used according to the scale used for that particular figure. The upper left hand corner of map a in each figure is adjacent to the existing seaward wall of the existing Fort Moultrie. Map b is the same rotated 90° counterclockwise, map c is rotated 90° further, etc. The different vertical scales were experimented with, enabling the three different impressions of the resistance values to be plotted.

It may easily be seen from these figures that there is a significant low resistance running through the center of the area. This may well represent a former ditch or some other feature of Fort Moultrie II. The high resistance peaks located just outside the walls of the fort reflect the stone breakwater beneath the surface that was described by South (1974). The most significant area appears to be located about 130 feet out from the southwest corner of the existing wall.

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